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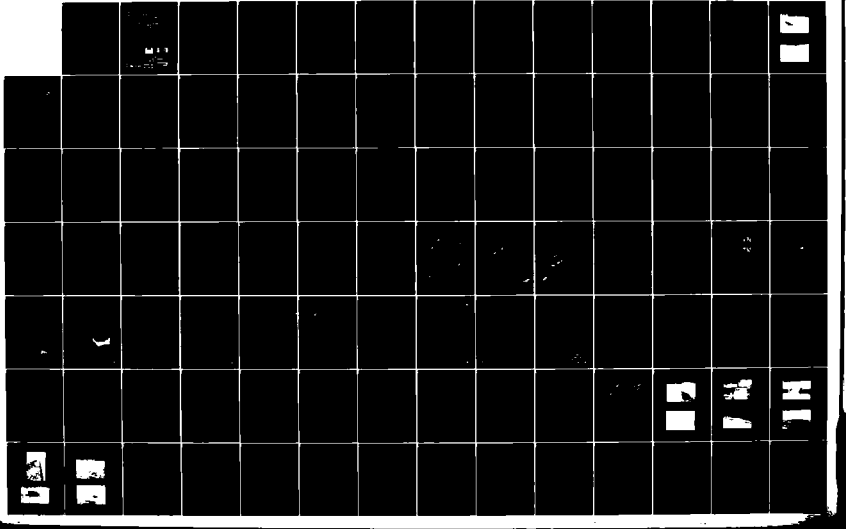

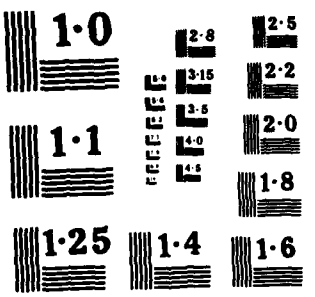
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MERRIMACK RIVER BASIN
LYNDEBOROUGH, NEW HAMPSHIRE

SOUHEGAN RIVER WATERSHED
DAM NO. 8
NH 00474
NHWRB 147.28

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

AUGUST 1978

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

DAMS, INSPECTION, DAM SAFETY,

Merrimack River Basin
Lyndeborough, New Hampshire
Furnace Brook, a tributary of Stony Brook (tributary of the Souhegan River)

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The dam is an earth embakment 570 ft. long and 25 ft.high. It is intermediate in size with a high hazard potential. The dam is in good condition at the present time. No conditions were observed which require further investigation.

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

REPLY TO
ATTENTION OF:
NEDED

DEC 21 1979

Honorable Hugh J. Gallen
Governor of the State of New Hampshire
State House
Concord, New Hampshire 03301

Dear Governor Gallen:

Inclosed is a copy of the Souhegan River Watershed Dam No. 8 Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Water Resources Board, the cooperating agency for the State of New Hampshire and the owner.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Water Resources Board for your cooperation in carrying out this program.

Sincerely,

MAX B. SCHEIDER
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

SOUHEGAN RIVER WATERSHED DAM NO. 8
NH 00474

MERRIMACK RIVER BASIN
HILLSBOROUGH COUNTY, NEW HAMPSHIRE

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

PHASE I REPORT

Identification No.:	NH 00474
NHWRB No.:	147.28
Name of Dam:	SOUHEGAN RIVER WATERSHED DAM NO. 8
Town:	Lyndeborough
County and State:	Hillsborough County, New Hampshire
Stream:	Furnace Brook, a tributary of Stony Brook, which is a tributary of the Souhegan River
Date of Inspection:	May 14, 1979

BRIEF ASSESSMENT

The Souhegan River Watershed Dam No. 8 is located on Furnace Brook, approximately 4 miles upstream of Wilton, New Hampshire. The dam is an earth embankment 570 feet long and 25 feet high with a concrete drop inlet service spillway structure and a 30 inch outlet conduit. An earth emergency spillway 150 feet wide is cut into the left abutment. There are 2 small dikes located on the west side and the south end of the reservoir at flood stage. These dikes, known as Cemetery Dike and South Dike, prevent the reservoir from flowing into the drainage area of another tributary.

The dam is owned by the New Hampshire Water Resources Board. It was designed by the Soil Conservation Service for the purpose of flood protection in the Souhegan River Watershed.

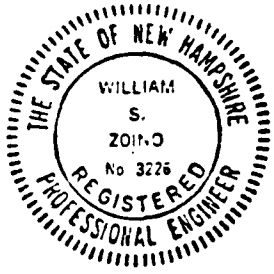
The drainage area of the dam covers 4.44 square miles and is made up primarily of rolling woodland. The dam has a maximum impoundment of 2541 acre-feet. The dam is INTERMEDIATE in size and its hazard classification is HIGH since significant property damage and loss of life could result in the event of a dam failure.

The test flood for this dam is the Probable Maximum Flood. The peak inflow for this flood is 8,390 cfs. Because of storage, the resulting peak discharge is 4,800 cfs compared to a total spillway capacity of 7,021 cfs. The water surface would be at elevation 701.7 feet (MSL) or 1.3 feet below the top of the dam for this flood.

The dam is in GOOD condition at the present time. Remedial measures to be undertaken by the owner include; replacing joint filler at impact basin; mowing of embankment slopes, backfilling tire ruts in embankment slopes; operating the drain gate during the annual inspection procedure; and developing a formal written emergency warning system for the dam.

No conditions were observed which require further investigation.

The remedial measures outlined above should be implemented within 2 years of receipt of this report by the owner, however, the program of annual technical inspections should be continued.



William S. Zoino
N.H. Registration No. 3226

Nicholas A. Campagna, Jr.
California Registration 21006

This Phase I Inspection Report on Sougegan River Watershed Dam No. 8 has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

Joseph A. McElroy

JOSEPH A. MCELROY, MEMBER
Foundation & Materials Branch
Engineering Division

Carney M. Terzian

CARNEY M. TERZIAN, MEMBER
Design Branch
Engineering Division

Joseph W. Finegan, Jr.

JOSEPH W. FINEGAN, JR., CHAIRMAN
Chief, Reservoir Control Center
Water Control Branch
Engineering Division

APPROVAL RECOMMENDED:

Joe B. Fryar

JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Test Flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the Test Flood should not be interpreted as necessarily posing a highly inadequate condition. The Test Flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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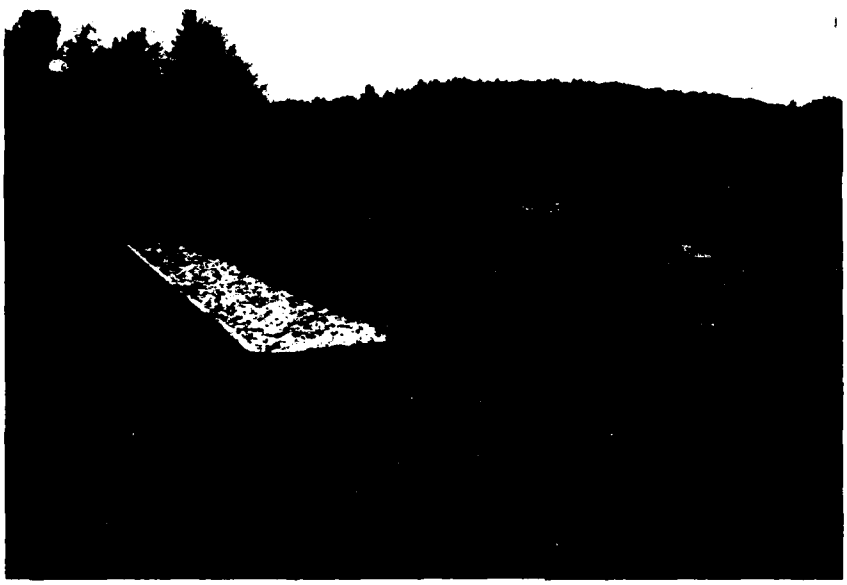
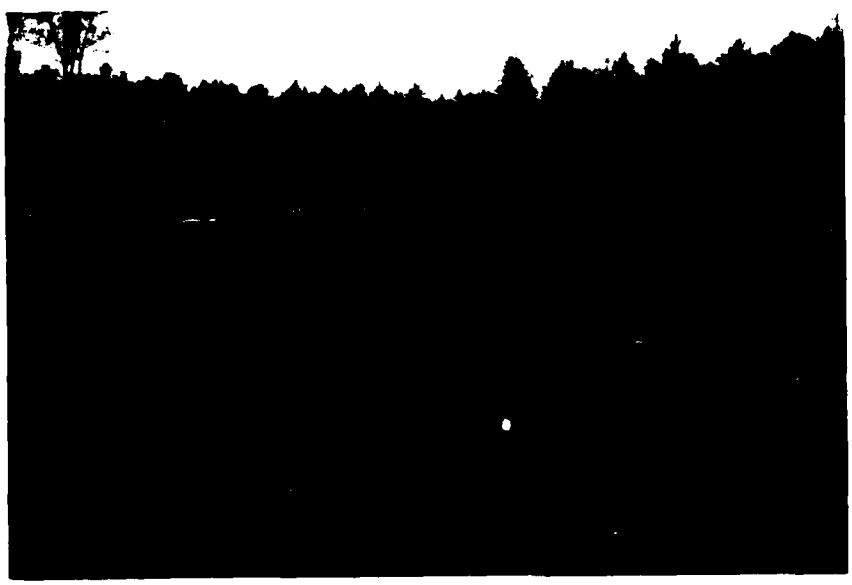


Overview across left emergency spillway



Overview from right abutment

SECTION 2 - ENGINEERING DATA

2.1 Design Data

Among other design data available from the Soil Conservation Service are hydrologic and hydraulic computations, structural computations, a geological report, soil laboratory test results, and embankment stability analysis computations. This information was used extensively in computations presented in Section 5 and Appendix D of this report.

2.2 Construction Data

"As built" plans are available for this dam and show good agreement with the design plans and the visual inspection.

2.3 Operational Data

No operational data is available as the dam is self regulating.

2.4 Evaluation of Data

(a) Availability

Sufficient data is available to permit an evaluation of the dam when combined with findings of the visual inspection.

(b) Adequacy

There is sufficient design and construction data to permit an assessment of dam safety when combined with the visual inspection, past performance, and sound engineering judgment.

(c) Validity

Since the observations of the inspection team generally confirm the available data, a satisfactory evaluation for validity is indicated.

4) Gates: 24 inch vertical lift sluice gate on pond drain inlet

5) Upstream channel: Reservoir

6) Downstream channel: Narrow channel through gently sloping flood plain

(j) Regulating Outlet

The only regulating outlet is a 24 inch diameter pipe controlled by a wheel operated sluice gate. The pipe invert is at elevation 683.25 feet (MSL). The purpose of this outlet is pond drainage, and it is normally closed.

8) Cutoff

a) Main dam: Variable width, earthfill

b) Cemetery dike: 12 feet wide at bottom, earthfill

c) South dike: None

9) Grout Curtain

a) Main dam: None

b) Cemetery dike: None

c) South dike: None

(h) Diversion and Regulating Tunnel

Not applicable

(i) Spillways

1) Type

a) Principal spillway: Reinforced concrete Drop inlet

b) Emergency spillway: Grass covered earth channel cut in left abutment

2) Length of weir

a) Pond drain inlet: 24 inch diameter pipe

b) Low stage inlet: 3.75 ft.

c) High stage inlet: 15 ft.

d) Emergency spillway: 150 ft.

3) Crest Elevation (ft. above MSL)

a) Pond drain inlet: 683.25

b) Low stage inlet: 688.5

c) High stage inlet: 692.5

d) Emergency spillway: 696.5

2) Length

a) Main dam: 570 ft.

b) Cemetery dike: 375 ft.

c) South dike: 330 ft.

3) Height

a) Main dam: 25 ft.

b) Cemetery dike: 16 ft.

c) South dike: 9 ft.

4) Top Width

a) Main dam: 12 ft.

b) Cemetery dike: 12 ft.

c) South dike: 12 ft.

5) Side Slopes

a) Main dam: Upstream: 3 to 1
Downstream: 2.5 to 1

b) Cemetery dike: Upstream: 2.5 to 1
Downstream: 2.5 to 1

c) South dike: Upstream: 2.5 to 1
Downstream: 2.5 to 1

6) Zoning

a) Main dam: Homogeneous, semi-pervious, silty sand with clay (SC & SC-SM)

b) Cemetery dike: Homogeneous, semi-pervious silty sand with clay (SC & SC-SM)

c) South dike: Semi-pervious silty sand with clay (SC & SC-SM) with downstream zone of sand and gravel(SP-SW)

7) Impervious Core

a) Main dam: None

b) Cemetery dike: None

c) South dike: None

(e) Storage (Acre feet)

Prior to construction of this dam a pond existed on this site at approximately the same elevation as the present normal pool (el. 688.5 ft. MSL). No data was disclosed as to the storage of this pool. The figures below represent the additional storage provided by the construction of this dam.

1) Normal pool: 0

2) Flood control pool: 941

3) Spillway crest pool

a) Low stage inlet: 0

b) High stage inlet: 272

c) Emergency spillway: 941

4) Top of dam: 2541

5) Test flood pool: 2202

(f) Reservoir Surface (acres)

1) Normal pool: 48

2) Flood control pool: 110 ±

3) Spillway crest pool

a) Low stage inlet: 48

b) High stage inlet: 79 ±

c) Emergency spillway: 110 ±

4) Test flood: 267 ±

5) Top of dam: 280 ±

(g) Dam

1) Type

a) Main dam: earth embankment

b) Cemetery dike: earth embankment

c) South dike: earth embankment

(c) Elevation (feet above MSL)

1) Streambed at centerline of dam: 678.0

2) Maximum tailwater: Unknown

3) Upstream portal invert diversion tunnel: Not applicable.

4) Normal pool: 688.5

5) Full flood control pool: 696.5

6) Spillway crest:

a) Pond drain inlet: 683.25

b) Low stage inlet: 688.5

c) High stage inlet: 692.5

d) Emergency spillway: 696.5

7) Design surcharge: 698.6

8) Top dam

a) Embankment: 703.0

b) Cemetery Dike: 703.0

c) South Dike: 703.0

9) Test flood design surcharge: 701.7

(d) Reservoir

1) Length of maximum pool: 5600 ± ft.

2) Length of normal pool: 4000 ± ft.

3) Length of flood control pool: 5600 ± ft.

(b) Discharge at Damsite

1) Outlet Works

Normal discharge at the site is through the 30 inch diameter outlet pipe. In the event of severe flooding water would flow over the emergency spillway at elevation 696.5 feet (MSL). The invert of the low stage orifice is at elevation 688.5 feet (MSL). The invert of the high stage orifice is at elevation 692.5 feet (MSL).

2) Maximum Known Flood

There is no data available for the maximum known flood at this damsite.

3) Ungated Spillway Capacity at Top of Dam

The capacity of the principal spillway with the reservoir at top of dam elevation (703.0 feet MSL) is 106 cfs. The capacity of the emergency spillway is 6915 cfs at this level.

4) Ungated Spillway Capacity at Test Flood

The capacity of the principal spillway with the reservoir at test flood elevation (701.7 feet MSL) is 102 cfs. The capacity of the emergency spillway is 4698 cfs at this level.

5) Gated Spillway Capacity at Normal Pool

There are no gated spillways. The gated pond drain inlet is normally closed.

6) Gated Spillway Capacity at Test Flood

As previously mentioned, there are no gated spillways.

7) Total Spillway Capacity at Test Flood

The total spillway capacity at test flood elevation (701.7 feet MSL) is 4800 cfs.

8) Project Discharge at Test Flood

The total project discharge at test flood elevation (701.7 feet MSL) is 4800 cfs.

failure. Section 5 of this report presents more detailed discussion of the hazard potential.

(e) Ownership

The dam is owned by the New Hampshire Water Resources Board, 37 Pleasant Street, Concord, New Hampshire 03301. They can be reached by telephone at area code 603-271-3406.

(f) Operator

The operation of the dam is controlled by the New Hampshire Water Resources Board. Key officials are as follows:

George McGee, Chairman
Vernon Knowlton, Chief Engineer
Donald Rapoza, Assitant Chief Engineer

The Board's telephone number is 603-271-3406. Alternatively, the Board can be reached through the state capital at 603-271-1110.

(g) Purpose of the Dam

The purpose of the dam is to reduce downstream flooding by providing temporary storage for the runoff from 4.44 square miles of watershed. This temporary storage is released through the low and high stage inlets of the principal spillway.

(h) Design and Construction History

The dam was designed by the U.S. Department of Agriculture, Soil Conservation Service in conjunction with the New Hampshire Water Resources Board. It was completed in 1977.

(i) Normal Operating Procedure

The dam is self regulating. The pond drain gate is operated only during infrequent maintenance checks.

1.3 Pertinent Data

(a) Drainage Area

The drainage area for this dam covers 4.44 square miles. It is made up primarily of rolling woodland with some pasture and minor development.

A concrete sill has been constructed across the control section of the emergency spillway. It is 250 feet long and of variable depth. Details of this structure are shown on page B-11. The top of this structure is flush with the ground surface at elevation 696.5 feet (MSL).

6) Foundation and Embankment Drainage

i) Main Dam (See pg. B-4)

A 4 foot wide trench drain of clean sand and gravel extends the full length of the downstream embankment. It contains two 6 inch perforated asbestos cement pipes. One extends 125 feet to the left of the outlet conduit, and the other extends 87 feet to the right of the outlet conduit. These pipes discharge on either side of the conduit.

ii) Cemetery Dike (See pg. B-6)

A 4 foot wide trench drain of clean sand and gravel extends beneath the downstream slope of embankment from 50 feet to the right of the left abutment to 90 feet to the left of the right abutment. The outlet for this drain is approximately 150 feet from the left abutment at the downstream toe and it is protected by rip-rap.

iii) South Dike (See pg. B-7)

The drainage feature of the South Dike is a zone of sand and gravel beneath the downstream shell of the embankment. It extends the full length of the embankment and the top of this zone is at elevation 699.0 feet (MSL).

(c) Size Classification

The dam's maximum impoundment of 2541 acre-feet and height of 25 feet place it in the INTERMEDIATE size category according to the Corps of Engineers' Recommended Guidelines.

(d) Hazard Potential Classification

The hazard potential classification for this dam is HIGH because of the significant economic losses and high potential for loss of life downstream in the event of dam

The "low stage inlet" consists of 2 uncontrolled openings approximately 5.25 feet above the sluice gate invert. They are 1 foot, 10.5 inches wide and 21 3/8 inches high and are located in the upstream and downstream faces of the riser structure. The water flows over these openings and drops into the riser structure. It is protected by a trash rack assembly approximately 6 feet high and 4 feet, 2 inches wide. This assembly is fabricated from galvanized steel angle sections.

The "high stage inlet" consists of 2 openings approximately 9.25 feet above the sluice gate invert. The openings are 7.5 feet wide and 18 inches high and are located in the left and right sides of the flared portion of the riser structure. They are protected by a galvanized steel grating 25 inches high placed in front of each high stage opening and 5 galvanized steel angles placed in the sloping section below each opening. A 30 inch diameter manhole permits access into the riser structure.

The riser structure is drained by a 30 inch diameter reinforced concrete pressure pipe. It is approximately 102 feet long and drops approximately 3.75 feet over that length. The pipe penetrates the downstream side of the riser structure and is supported by a 4 inch thick concrete cradle within the embankment. Plans indicate 4 concrete anti-seep collars cast around the pipe within the embankment.

The pipe outlets into an impact basin constructed of reinforced concrete. This structure is similar to that outlined in "Design of Small Dams", Chapter VIII, Section E as printed by the U. S. Department of the Interior, Bureau of Reclamation. Details of this structure are shown on page B-5.

The earth emergency spillway was excavated in the left abutment. It curves to the right around the embankment and is 150 feet wide at the control section. It is approximately 700 feet long and lies approximately 6.5 feet below the top of the embankment. The side slopes are 3 horizontal to 1 vertical.

Beneath the embankment is an earthfill cutoff trench, 12 feet wide at the bottom. According to available plans, it is constructed of the same material as the embankment. The cutoff trench was designed and constructed to extend to firm bedrock or glacial till.

3) South Dike (See pg. B-7)

The embankment is made up primarily of silty fine sand (Designation SM using the Unified Soil Classification System). It is 330 feet long and is a maximum of 9 feet high. The upstream and downstream slopes are 2.5 horizontal to 1 vertical and the width of the crest is 12 feet.

According to available plans there is no cutoff trench beneath this embankment. The foundation is composed of glacial outwash and till material according to the SCS geological report.

4) Principal Spillway (See pgs. B-3, B-5, & B-9)

The principal spillway consists of a reinforced concrete drop inlet structure with a sluice gate controlled inlet pipe and two uncontrolled orifice inlets; a 30 inch outlet pipe supported on a concrete cradle; and an impact basin.

The riser structure is 13.5 feet high and 9 feet 2 inches wide normal to the axis of the dam. It is 4 feet 2 inches long parallel to the embankment and flares to 14 feet 2 inches long at the top. The walls of the structure are 10 inches thick and the top slab is 8 inches thick.

At the base of the structure is a 24 inch diameter, vertical lift, sluice gate inlet which is controlled by a crank operated bench stand with a rising stem. A 24 inch diameter, concrete pressure pipe extends 11 feet upstream from the lift gate into the impoundment pool. Plans indicate a reinforced concrete inlet structure at the upstream end of this pipe which is protected by a trash rack of galvanized steel angles placed vertically across the opening.

1.2 Description of Project

(a) Location

The Souhegan River Watershed Dam No. 8 is located on Furnace Brook approximately 4 miles upstream of Wilton, New Hampshire. It can be reached from Cemetery Road which intersects State Route 31 in South Lyndeborough, New Hampshire. The dam is shown on USGS quadrangle, Peterborough, New Hampshire, at approximate coordinates N 42° 53.1', W 71° 46.1' (see location map on page v). Page B-2 of Appendix B is a site plan for this dam.

(b) Description of Dam and Appurtenances

The dam consists of an earth embankment with an earthfill cutoff trench below the embankment, a principal spillway with a reinforced concrete riser and outlet pipe, and an earth emergency spillway 150 feet wide, located at the left abutment. The length of the dam is 570 feet. Two small dikes, referred to as "Cemetery Dike" and "South Dike", are located at the west side and the south end of the flood stage reservoir area. These dikes serve to define the drainage area of this dam.

1) Main Dam Embankment (See pgs. B-3, B-4, B-5, & B-10)

The embankment was constructed of silty sand with clay (Designation SC & SC-SM using the Unified Soil Classification System). It is 570 feet long and is a maximum of 25 feet high. The upstream slope is 3 horizontal to 1 vertical; the downstream slope is 2.5 horizontal to 1 vertical; and the width of the crest is 12 feet.

Beneath the embankment is an earthfill cutoff trench of variable bottom width. According to available plans, it is constructed of the same silty sand with clay material as the embankment. The cutoff trench was designed to extend to firm bedrock or glacial till.

2) Cemetery Dike (See pg. B-6)

The embankment is made up primarily of silty sand with clay (Designation SC & SC-SM using the Unified Soil Classification System). It is 375 feet long and is a maximum of 16 feet high. The upstream and downstream slopes are 2.5 horizontal to 1 vertical; and the width of the crest is 12 feet.

PHASE I INSPECTION REPORT

SOUHEGAN RIVER WATERSHED DAM NO. 8

SECTION 1

PROJECT INFORMATION

1.1 General

(a) Authority

Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Goldberg, Zoino, Dunnicliff & Associates, Inc. (GZD) has been retained by the New England Division to inspect and report on selected dams in the State of New Hampshire. Authorization and notice to proceed were issued to GZD under a letter of March 30, 1979 from Colonel John P. Chandler, Corps of Engineers. Contract No. DACW 33-79-C-0058 has been assigned by the Corps of Engineers for this work.

(b) Purpose

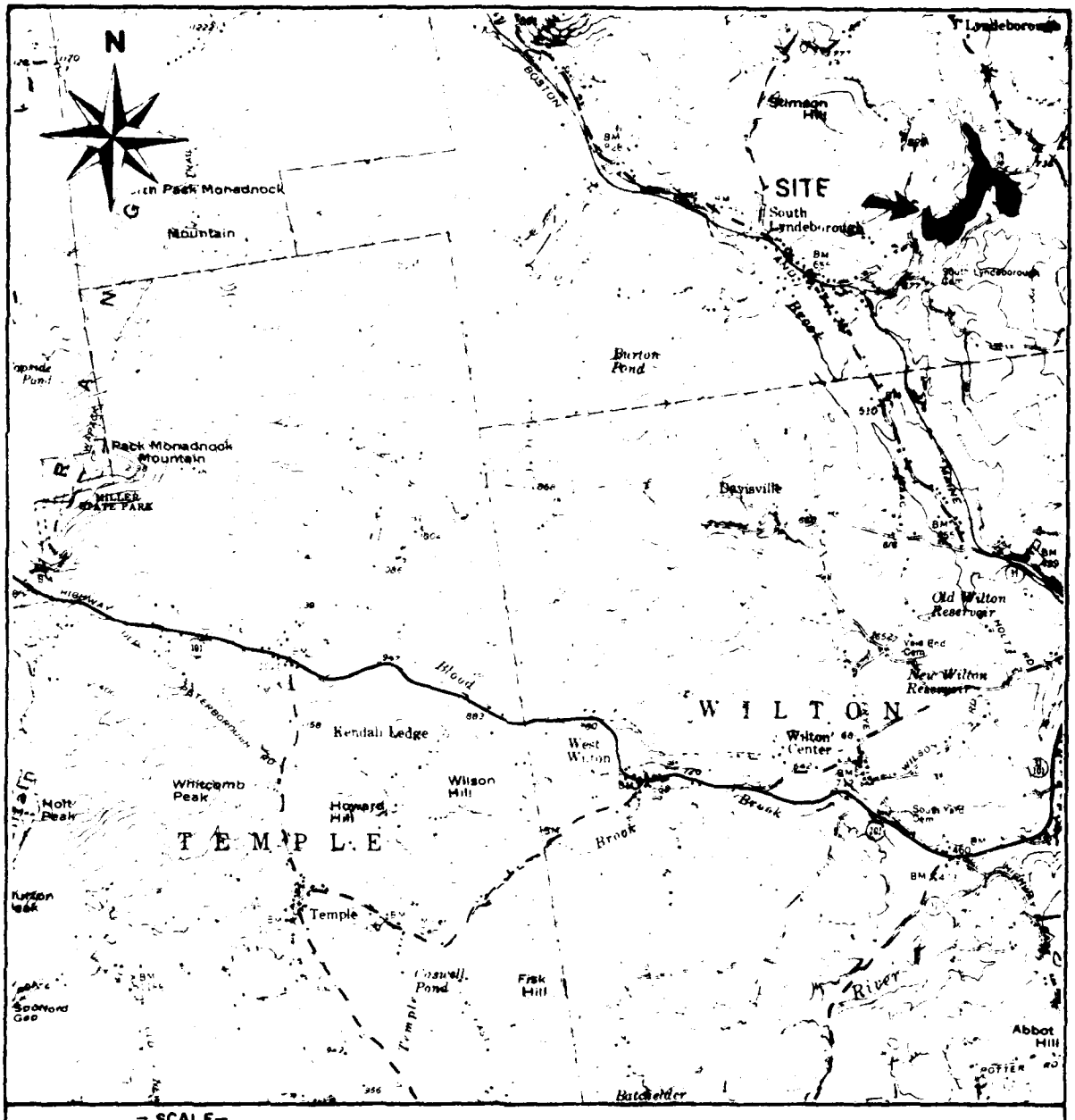
1) Perform technical inspection and evaluation of non-federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-federal interests.

2) Encourage and prepare the states to initiate quickly effective dam safety programs for non-federal dams.

3) Update, verify, and complete the National Inventory of Dams.

(c) Scope

The program provides for the inspection of non-federal dams in the high hazard potential category based upon location of the dams, and those dams in the significant hazard potential category believed to represent an immediate danger based on condition of the dams.



— SCALE —

0 1/2 1 (MILES)

FROM: USGS PETERBOROUGH - N.H. QUADRANGLE MAP

GOLDBERG, ZOINO, DUNNICLIFF & ASSOC., INC.
GEOTECHNICAL CONSULTANTS
NEWTON UPPER FALLS, MASS.

U.S. ARMY ENGINEER DIV. NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

LOCUS PLAN

SOUHEGAN RIVER WATERSHED
DAM No. 8
NEW HAMPSHIRE

FILE No. 2327

SCALE	AS NOTED
DATE	MAY 1979

SECTION 3 - VISUAL INSPECTION

3.1 Findings

(a) General

The Souhegan River Watershed Dam No. 8 is in GOOD condition at the present time.

(b) Dam

1) Main Dam Embankment (See photos 1, 2 & 6)

Tire ruts, 6 to 8 inches deep, were found along the downstream toe of the embankment at the right abutment and some minor erosion of the downstream slope was noted just above the impact basin. The upstream slope is not protected by riprap, but is in good condition.

A fabric netting material has been placed on the downstream slope, near the abutments, as erosion protection. It appears to be performing satisfactorily in this capacity.

The toe drains were partially submerged due to high tailwater at the time of inspection and flows could not be measured.

2) Emergency Spillway (See photo 7)

The earth emergency spillway is in good condition. There are wet spots in the channel but these are caused by natural groundwater or ponded runoff.

3) Cemetery Dike (See photos 9 & 10)

This dike appears stable and in good condition. The trench drain is functioning. The seepage from this drain is not excessive.

4) South Dike (See photo 8)

Small erosion gullies, 2 to 3 inches deep, were found in the downstream slope of the embankment.

(c) Appurtenant Structure

1) Drop Inlet Service Spillway Structure (See photos 1 & 3)

The structure is in good condition with no evidence of spalling, cracking, or efflorescence. The sluice gate bench stand is in good condition. The hand crank has been removed from the site to prevent unauthorized use. The trash racks are in good condition but are clogged with debris.

2) Pond Drain Inlet Pipe

At the time of inspection the 24 inch pond drain inlet pipe was completely submerged and could not be observed.

3) Outlet Conduit (See photo 4)

The downstream end of the outlet pipe was submerged up to its crown. The preformed joint filler between the pipe and the impact basin headwall has been washed out.

4) Impact Basin (See photos 2 & 5)

The impact basin and chain link fence are in good condition.

5) Emergency Spillway Sill (See photo 7)

The emergency spillway sill is in good condition with some minor spalling of the exposed surface.

(d) Reservoir Area

The shore of the reservoir is generally shallow sloping woodland. It appears stable and in good condition.

(e) Downstream Channel

The downstream channel is a narrow channel passing over relatively flat flood plain. The channel appears stable and in good condition. Riprap protection of the plunge pool is in good condition.

3.2 Evaluation

The dam and its appurtenant structures are generally in good condition. The potential problems noted during the visual inspection are listed as follows:

a) Tire ruts and erosion gullies in the slope of the main dam embankment.

b) Erosion gullies in the downstream slope of the south dike.

c) Debris clogging the low stage trash racks.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 Procedures

No written operational procedures exist. The dam is self regulating.

4.2 Maintenance of Dam

An annual inspection is made jointly by the New Hampshire Water Resources Board and the Soil Conservation Service. Recommendations resulting from this inspection are implemented by the NHWRB.

4.3 Maintenance of Operating Facilities

Operation of the sluice gate for the pond drain inlet is checked approximately once every four or five years by NHWRB.

4.4 Description of Warning System in Effect

There is no warning system in effect.

4.5 Evaluation

The established operational procedures for this dam are generally satisfactory. Additional emphasis on routine maintenance will assist the owners in assuring the long-term safety of the dam. A formal, written, downstream emergency warning system should be developed for this dam.

SECTION 5 - HYDROLOGY/HYDRAULICS

5.1 Evaluation

(a) General

Souhegan River Watershed Dam No. 8 is a Soil Conservation Service (SCS) flood control dam on Furnace Brook in Lyndeborough, New Hampshire. The dam is about 8000 feet upstream of the confluence of Furnace and Stony Brooks, and about 4 miles upstream of the confluence of Stony Brook and the Souhegan River. The upstream drainage area is 4.44 square miles with rolling topography.

The dam itself is a 570 foot long earthen embankment with a grass-lined earth emergency spillway 150 feet wide. The principal spillway consists of 4 orifices located on a concrete riser in the reservoir. Flow from the orifices proceeds under the dam through a reinforced concrete pipe. There are 2 smaller dikes associated with the dam.

(b) Design Data

The data sources available for Souhegan River Watershed Dam No. 8 include some of the Soil Conservation Service's (SCS) "Hydrology and Hydraulics" Design Calculations. The portion of the calculations available is dated 1976.

Also available for this dam is an SCS "Maintenance Checklist" report on a dam inspection dated June 15, 1978.

The Soil Conservation Service Design plans, dated 1975, are also available for this dam.

(c) Experience Data

No records of flow or stage are known to be available for Souhegan River Watershed Dam No. 8.

(d) Visual Observation

The main dam consists of a 570 foot long earthen embankment with a crest elevation of 703 feet MSL. There are 2 dikes associated with this reservoir. One, the Cemetery Dike, is about 1,000 feet south of the main dam, across Cemetery Road. It is approximately 375 feet long, with a crest elevation of 703 feet MSL. The second dike, called South Dike, separates the drainage area of Souhegan River Watershed Dam No. 8 from that of Souhegan River Watershed Dam No. 33. It is approximately 295 feet long, with a crest elevation of 703 feet MSL.

The emergency spillway is a 150 foot wide grass-lined earth channel, with crest elevation 696.5 feet MSL and 3:1 side slopes. There is a 50 foot wide shelf on either side at elevation 699 feet MSL. The spillway elevation is controlled by a concrete sill across the channel. Flow from this spillway rejoins Furnace Brook about 800 feet downstream of the dam. The flow from the principal spillway passes under the dam to the brook through a 30 inch reinforced concrete pipe 110.9 feet long.

The only controlled outlet at the dam is a 24 inch reinforced concrete pipe with its invert at elevation 683.25 feet MSL which also feeds into the riser and the 30 inch reinforced concrete pipe under the dam. This outlet is a pond drain, and is usually closed. It is operated by a valve on the top of the riser structure. There are no outlets at Cemetery Dike or South Dike.

For a few hundred feet downstream of the dam, Furnace Brook is flat and swampy, with water surface elevation controlled by beaver dams. After about 500 feet, Furnace Brook becomes a mountain stream, and runs 4,000 feet to a Boston and Maine Railroad bridge. The only development in this reach is 2 unpaved road crossings on culverted earth embankments.

After the Boston and Maine Railroad bridge, Furnace Brook runs another 4000 feet to its confluence with Stony Brook. There are 4 houses 15 to 20 feet above the streambed in this reach.

Downstream of the confluence, Stony Brook flows 6500 feet to its confluence with Stockwell Brook. There are 1 to 5 houses and a factory (under construction) about 15 feet above the streambed in this reach. New Hampshire Highway 31 parallels the brook in this reach.

Downstream of Stockwell Brook, Stony Brook flows about 6000 feet to the town of Wilton. The brook is paralleled by Highway 31 and crossed by a Boston and Maine Railroad bridge in this reach. At the outskirts of Wilton, there is a group of about 10 houses, an apartment, and a laundry between New Hampshire Highway 31 and Stony Brook. The ground floors of these structures range from 7 to 18 feet above the streambed. The gradient of Stony Brook flattens out in this reach, and in the middle of the town of Wilton the brook flows over Abbott Memorial Trust Dam and joins the Souhegan River.

The Souhegan River flows through Wilton, and has 5 to 10 residences and industrial buildings on its banks there. Below Wilton the Souhegan runs through about a 5 mile reach with a wide flood plain before reaching Milford, New Hampshire.

(e) Test Flood Analysis

The hydrologic conditions of interest in this Phase I investigation are those required to assess the dam's overtopping potential and its ability to safely allow an appropriately large flood to pass. This requires using the discharge and storage characteristics of the structure to evaluate the impact of an appropriately sized Test Flood. Some of the original hydraulic and hydrologic design calculations of the SCS are available for this dam.

Guidelines for establishing a recommended Test Flood based on the size and hazard classification of a dam are specified in the "Recommended Guidelines" of the Corps of Engineers. The impoundment of between 1,000 and 50,000 acre-feet and the height of less than 100 feet classify this dam as an INTERMEDIATE structure.

The appropriate hazard classification for this dam is HIGH because of the significant economic losses and potential for loss of life downstream in the event of dam failure. As shown in the Dam Failure Analysis section, the increase in flooding caused by failure would pose a threat to property and to lives in the village of Wilton. Other impacts of dam failure include damage to a heavily traveled highway and to several small roads (see Dam Failure Analysis section).

As shown in Table 3 of the Corps of Engineers' "Recommended Guidelines", the appropriate Test Flood for a dam classified as INTERMEDIATE in size with a HIGH hazard potential would be the probable maximum flood (PMF). For the 4.44 square mile drainage area with rolling topography, the Corps of Engineers' "Maximum Probable Peak Flow Rates" curve gives a peak inflow of 1,890 csm, which is equivalent to 8,390 cfs. Use of the Corps' suggested methodology for determining attenuation by storage results in a peak outflow of 4,800 cfs, with the water surface at 701.7 feet MSL, 1.3 feet below the dam crest and 13.2 feet above normal pool.

This analysis assumes that the reservoir elevation is 691.5 feet (MSL) at the beginning of the storm. This is 3 feet above the normal pool. The time for the reservoir to drawdown from the spillway crest to 691.5 feet (MSL) is 5.5 days. The drawdown time from the spillway crest to normal pool is 13 days.

(f) Dam Failure Analysis

The peak outflow that would result from the failure of Souhegan River Watershed Dam No. 8 is estimated using the procedure suggested in the Corps of Engineers New England Division's April 1978 "Rule of Thumb Guidelines for Estimating Downstream Dam Failure Hydrographs", as clarified in a December 7, 1978 meeting at the Corps' Waltham office. Normally this procedure is carried out with dam failure assumed to occur when the water surface reaches the top of the dam. In this case, however, the outflow of 7,020 cfs with the water surface at the top of the dam (703 feet MSL) is greater than the Probable Maximum Flood (PMF) routed outflow at the dam. Also, this outflow would create serious flooding downstream prior to dam failure. Failure is therefore assumed to occur with the water surface at the SCS Design High Water of 699 feet MSL, 4 feet below the top of the dam.

Of the 3 embankments associated with Souhegan River Watershed Dam No. 8, the main dam would cause the most damage upon failure. However, the effects of the failure of South Dike and Cemetery Dike were also considered.

Assuming no tailwater, a water surface elevation of 699 feet MSL at failure, and an 86 foot failure breach, South Dike would have a peak dam failure flow of 1,625 cfs. This would flow to the drainage area of Souhegan River Watershed Dam No. 33. This large flow, and the large volume of water released, might threaten overtopping of Dam No. 33 if natural inflows to that dam were already large.

Assuming no tailwater, a water surface elevation of 699 feet MSL at failure, and a 94 foot failure breach, Cemetery Dike would have a peak dam failure outflow of 6,570 cfs. There is no well-defined channel downstream of the dike, so it is difficult to predict the extent of flooding. There is 1 house about 1,300 feet downstream of Cemetery Dike (just upstream of Cran Hill Road) which might be affected by failure flow from Cemetery Dike before the flow would rejoin Furnace Brook.

The discharge at the main dam just prior to failure at this elevation is given by the Stage-Discharge curve developed in Appendix D as 1,430 cfs. The tailwater elevation prior to failure at this discharge is estimated to be 685 feet MSL.

For an assumed breach width equal to 40 percent of the dam width at the half-height, the gap in the embankment due to failure would be 84 feet. The resulting increase in flow would be 7400 cfs or a total of about 8830 cfs.

From 500 feet to 4,500 feet downstream of the dam Furnace Brook is a steep, narrow, mountain stream. The only development in this reach is 2 unpaved road crossings and a Boston and Maine Railroad bridge at the downstream end. The attenuated peak dam failure flow at the downstream end of this reach would be 8580 cfs, and would raise the stage from about 7 feet to about 12 feet. This would severely overtop the 2 road crossings, but would probably not affect the railroad bridge, which has a 30 foot high by 40 foot opening.

Downstream of the railroad bridge, Furnace Brook runs about 4,000 feet more to Stony Brook. This reach has 4 houses 15 to 20 feet above the stream as the only development. The peak attenuated dam failure flow of 8,160 cfs at the downstream end of this reach would increase the stage from about 6 feet to about 9 feet, which should not cause any significant damage.

For the 6,500 feet from its confluence with Furnace Brook to its confluence with Stockwell Brook, Stony Brook is fairly flat with a broad flat area on the southwest bank about 15 feet above the streambed. This flat area contains New Hampshire Highway 31, a large factory (under construction), and 1 to 5 houses. The peak attenuated dam failure flow of 7,680 cfs at the downstream end of this reach would increase the stage from about 4 feet to about 8 feet, which should cause only minor damage in this reach.

After Stockwell Brook joins Stony Brook, Stony Brook is paralleled by Highway 31 for about 6,000 feet to the town of Wilton. There is no development in this reach except the highway, which is above dam failure flows.

Just outside of Wilton there are a number of houses along the banks of Stony Brook. There are 9 houses 7 to 12 feet above the streambed, and 2 about 18 feet above. There is also an apartment building 12 feet above the streambed and a laundry about 10 feet up. Highway 31 parallels the brook about 10 feet above the streambed, and there are numerous dwellings and commercial establishments on the other side of the highway about 20 to 25 feet above the streambed.

The assumed pre-failure flow of 2,430 cfs (assuming 500 cfs of inflow from Stony Brook and 500 cfs from Stockwell Brook) would create a stage of 9 feet in this reach, which would cause some flooding at the low-lying houses in this reach. The dam failure outflow of 7,510 cfs would yield a stage of about 14 feet on Stony Brook, which would cause serious flooding in this reach.

Downstream of the residences and still in the town of Wilton, Stony Brook passes over Abbott Memorial Trust Dam and flows into the Souhegan River. The flow of about 7,510 cfs would create flooding on the Souhegan in Wilton, along which a few (5 to 10) houses and businesses are located. Downstream of Wilton the Souhegan flows through about 5 miles of broad flood plain before reaching the town of Milford. It is expected that the dam failure outflow would be essentially attenuated in this reach.

SECTION 6 - STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

(a) Visual Observations

There has been no significant displacement or distress which would warrant the preparation of structural stability calculations.

(b) Design and Construction Data

1) Embankment

No records of an embankment slope stability assessment are available for this dam.

2) Principal Spillway Structures

A review of the structural calculations for the design of the drop inlet service spillway structure and the outlet conduit (principal spillway) revealed that these structures have been designed on the basis of sound engineering practice.

(c) Operating Records

There are no known operating records for this dam.

(d) Post Construction Changes

There have been no known construction changes since the dam was completed in 1977.

(e) Seismic Stability

The dam is located in seismic zone No. 2 and, in accordance with the recommended Phase I guidelines, does not warrant seismic analysis.

SECTION 7 - ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 Dam Assessment

(a) Condition

The dam and its appurtenances are generally in good condition at the present time.

(b) Adequacy of Information

There is sufficient design and construction data to permit an assessment of dam safety when combined with the visual inspection, past performance, and sound engineering judgment.

(c) Urgency

The remedial measures described herein should be implemented by the owner within 2 years of receipt of this phase I Inspection Report.

(d) Need for Additional Investigations

None

7.2 Recommendations

No conditions were observed which warrant further investigation.

7.3 Remedial Measures

It is recommended that the owner institute the following remedial measures:

1) Check the operability of the pond drain inlet gate as part of the annual inspection procedure.

2) Develop a downstream emergency warning system.

3) Maintain the program of annual technical inspections.

4) Implement and intensify a program of diligent and periodic maintenance including, but not limited to: mowing brush on slopes; backfilling animal burrows, erosion gullies, and clearing debris from trash racks.

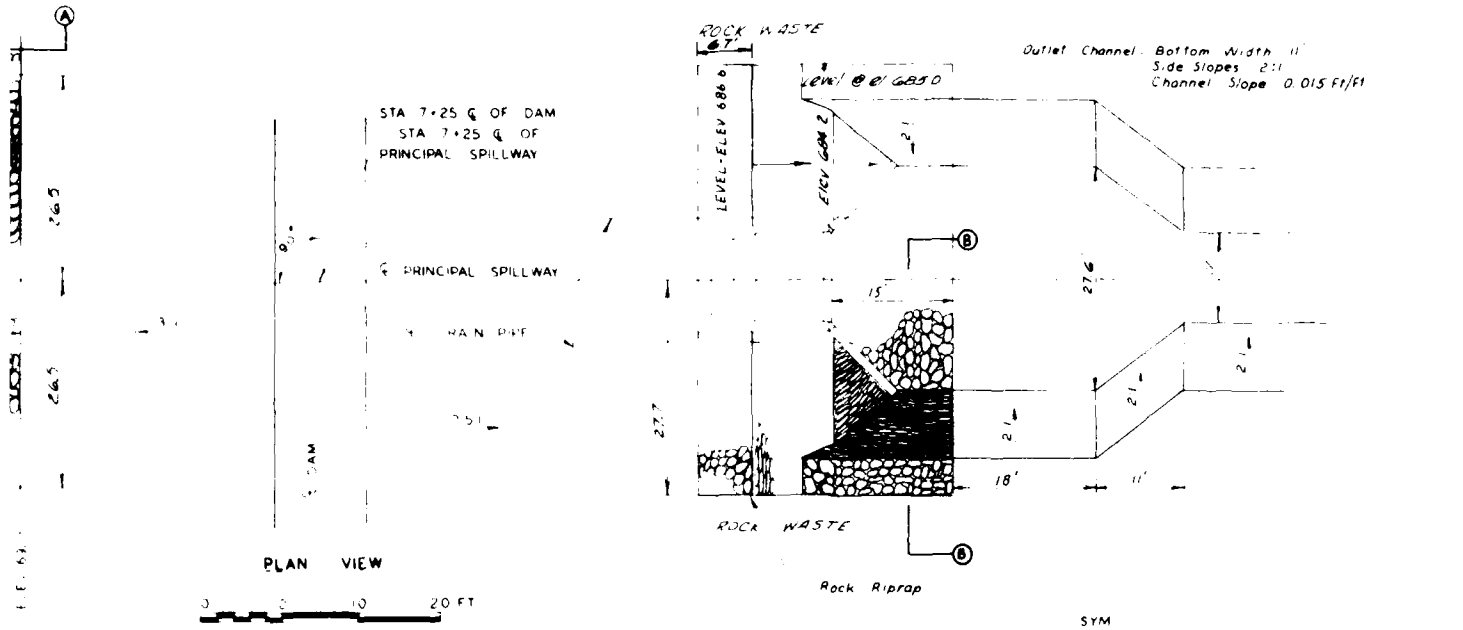
5) Replace the missing joint filler between the outlet conduit and the impact basin wall.

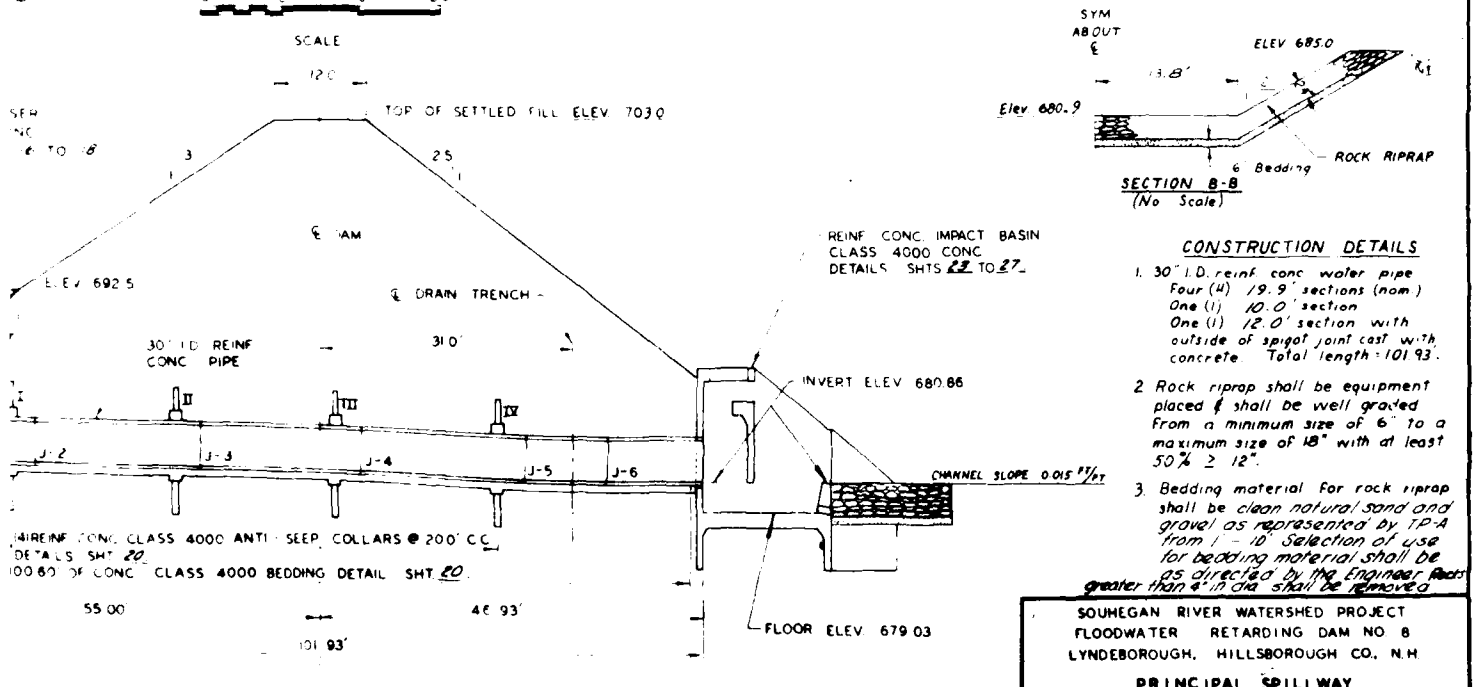
7.4 Alternatives

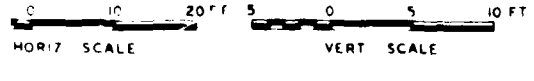
There are no meaningful alternatives to the above recommendations.

APPENDIX A

VISUAL INSPECTION CHECKLIST







SECTION B-B
(No Scale)

CONSTRUCTION DETAILS

1. 30" I.D. reinf. conc. water pipe
   Four (4) 19.9' sections (nom.)
   One (1) 10.0' section
   One (1) 12.0' section with outside of spigot joint cast with concrete. Total length = 101.93'.
2. Rock riprap shall be equipment placed & shall be well graded from a minimum size of 6" to a maximum size of 18" with at least 50% ≥ 12".
3. Bedding material for rock riprap shall be clean natural sand and gravel as represented by TP-A from 1' - 10'. Selection of use for bedding material shall be as directed by the Engineer. Rocks greater than 4" in dia. shall be removed.

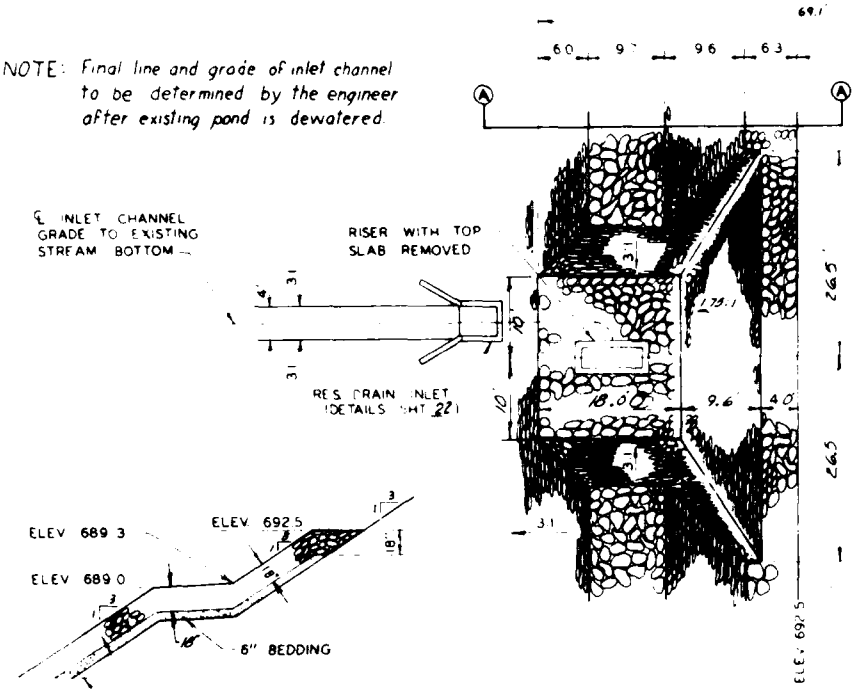
SOUHEGAN RIVER WATERSHED PROJECT
FLOODWATER RETARDING DAM NO. 8
LYNDEBOROUGH, HILLSBOROUGH CO., N.H.

PRINCIPAL SPILLWAY

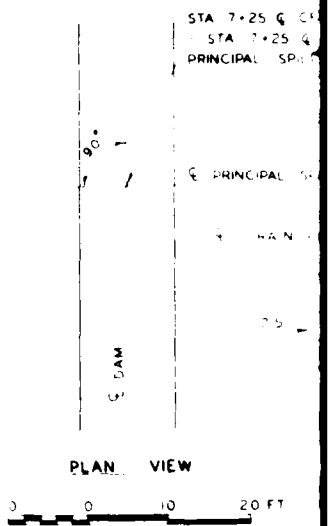
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

	Date	
Designed J. H. O'Mara	4-75	Approved by
Drawn N. Wahraman	4-76	Title
Traced		Title
Checked		Sheet No. 12 of 46 — Drawing No. NH 815 P

NOTE: *Final line and grade of inlet channel to be determined by the engineer after existing pond is dewatered.*

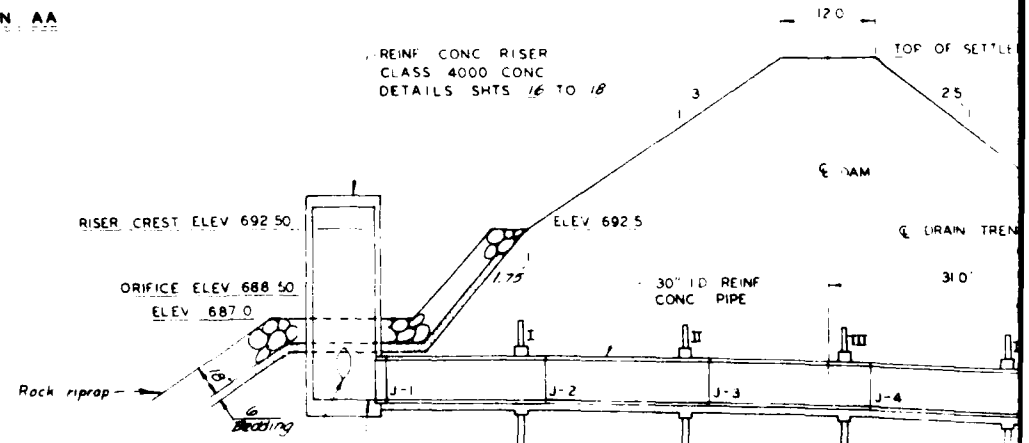


SECTION AA



PLAN VIEW

SCALE



COLLAR	DISTANCE FROM RISER WALL	INVERT OF 30" ϕ PIPE
I	17.0	682.00
II	37.0	681.91
III	57.0	681.61
IV	77.0	681.08

JOINT	DISTANCE FROM RISER WALL	INVERT OF 30" ϕ PIPE
J-1	0.33	682.00
J-2	20.23	682.00
J-3	40.13	681.89
J-4	60.03	681.56
J-5	79.93	681.00
J-6	89.93	680.86
OUTLET	101.93	680.88

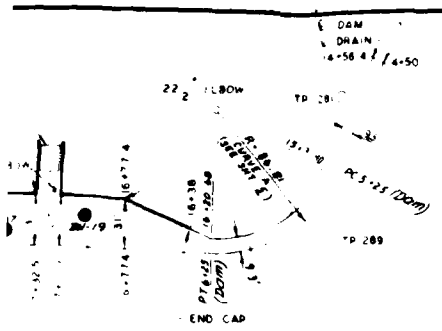
NOTE

DIMENSIONS FOR PIPE LENGTHS ARE BASED ON NOMINAL LENGTHS AND DO NOT INCLUDE CREEP

PROFILE ALONG CENTERLINE OF PRINCIPAL SPILLWAY

HORIZ SCALE

VERT SCALE



DRAIN FILL REQUIREMENTS (DAM AND CEMETERY DIKE)			
FINE		COURSE	
SIEVE NO	% PASSING	SIEVE NO	% PASSING
3/8	100	1"	100
4	95-100	3/4	88-100
10	57-85	1/2	38-100
20	24-60	3/8	20-90
40	0-35	4	0-41
60	0-20	200	0-3
100	0-5	—	—
200	0-3		

NOTE EXCAVATION LIMITS SHOWN ARE FOR PAYMENT PURPOSES ONLY OTHER EQUIVALENT MEANS MAY BE PROVIDED TO STABILIZE SIDE SLOPES AS REQUIRED BY OSHA REGULATIONS

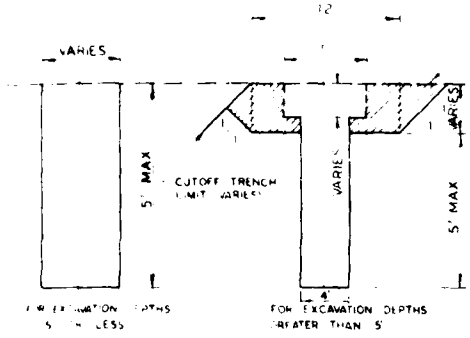
CONSTRUCTION DETAILS

1. PERFORATED ASBESTOS CEMENT PIPE (ACP) SHALL CONFORM TO SPEC 545 AND SHALL BE 6" DIA PRESSURE PIPE, CLASS 150, TYPE II
2. POLYVINYL CHLORIDE (PVC) PIPE SHALL CONFORM TO SPEC 400 AND SHALL BE 6" DIA AND PERFORATED
3. DUCTILE CAST IRON (CI) PIPE SHALL CONFORM TO SPEC 401 AND SHALL BE 6" NOMINAL DIA
4. THE EXCAVATION LIMITS SHOWN ARE APPROXIMATE AND WILL BE ADJUSTED IN ACCORDANCE WITH CONDITIONS ENCOUNTERED
5. ROCK EXPOSED ON THE BOTTOM OF THE DRAIN TRENCH SHALL BE THOROUGHLY CLEANED AND SHALL BE INSPECTED BY THE ENGINEER PRIOR TO PLACEMENT OF DRAIN MATERIAL
6. LOOSE AND FRACTURED ROCK IN THE BOTTOM OF THE DRAIN TRENCH SHALL BE REMOVED. NO BLASTING SHALL BE ALLOWED FOR ROCK REMOVAL IN DRAIN TRENCH. THE EXTENT OF LOOSE ROCK REMOVAL SHALL BE DETERMINED BY THE ENGINEER

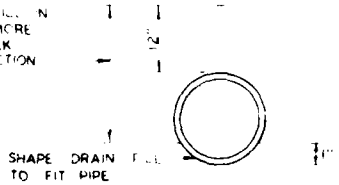
℄ PRINCIPAL SPILLWAY

SYSTEM

100 FT



HAND TAMP PLACE DRAIN FILL IN LAYERS NOT MORE THAN 4" THICK BEFORE COMPACTION



TAMP DRAIN FILL FIRMLY UNDER AND ADJACENT TO PIPE USING APPROVED CURVED AND FLAT TAMPING TOOLS

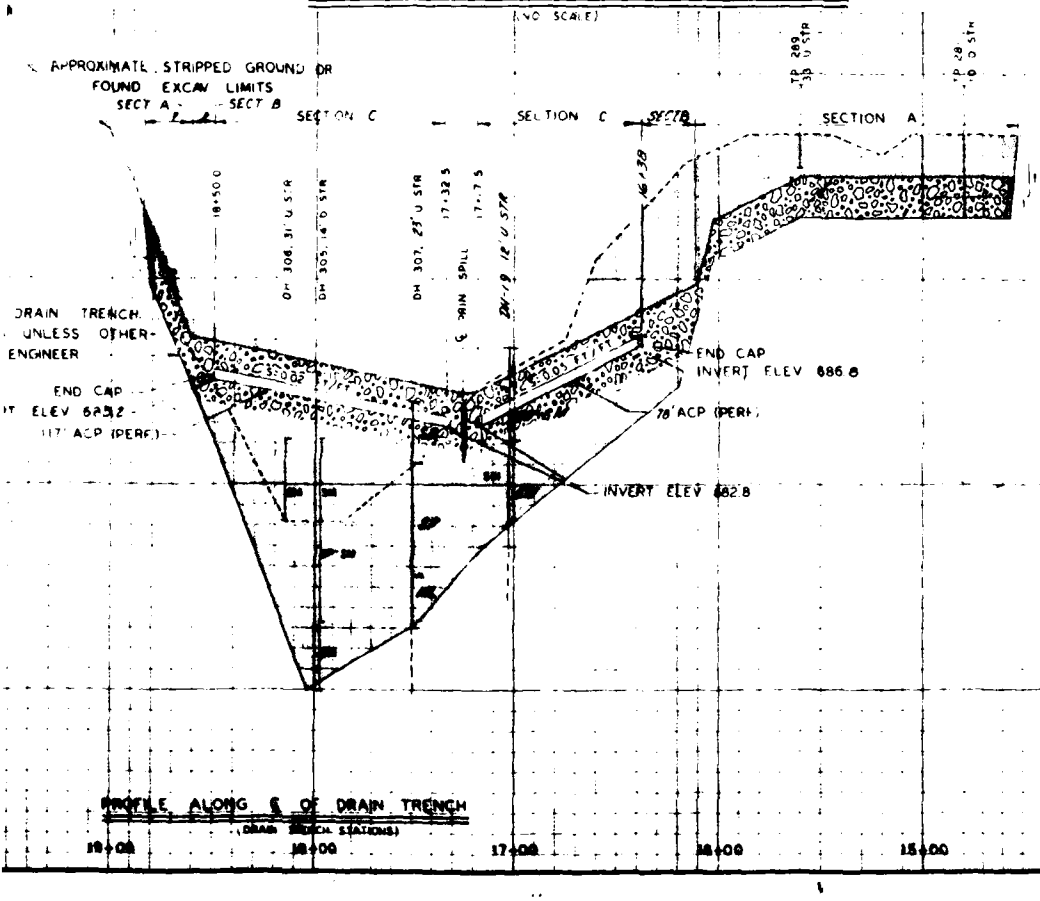
SHAPE DRAIN FILL TO FIT PIPE

TYPICAL CROSS SECTIONS FOR DRAIN TRENCH EXCAVATION

(NO SCALE)

DRAIN PIPE BEDDING DETAIL

(NO SCALE)



PROFILE ALONG ℄ OF DRAIN TRENCH

(DRAIN TRENCH STATIONS)

18+00 18+00 17+00 16+00 15+00

CONSTRUCTION DETAILS

7. A MINIMUM COVER OF 1' OF FINE DRAIN FILL SHALL BE PLACED OVER ALL COURSE DRAIN FILL
8. EXTEND 5' WIDTH OF DRAIN TRENCH EXCAVATION AND DRAIN FILL PLACEMENT 1' BEYOND END CAPS.

SOUHEGAN RIVER WATERSHED PROJECT
FLOODWATER RETARDING DAM NO 8
LYNDEBOROUGH, HILLSBOROUGH CO., N.H.

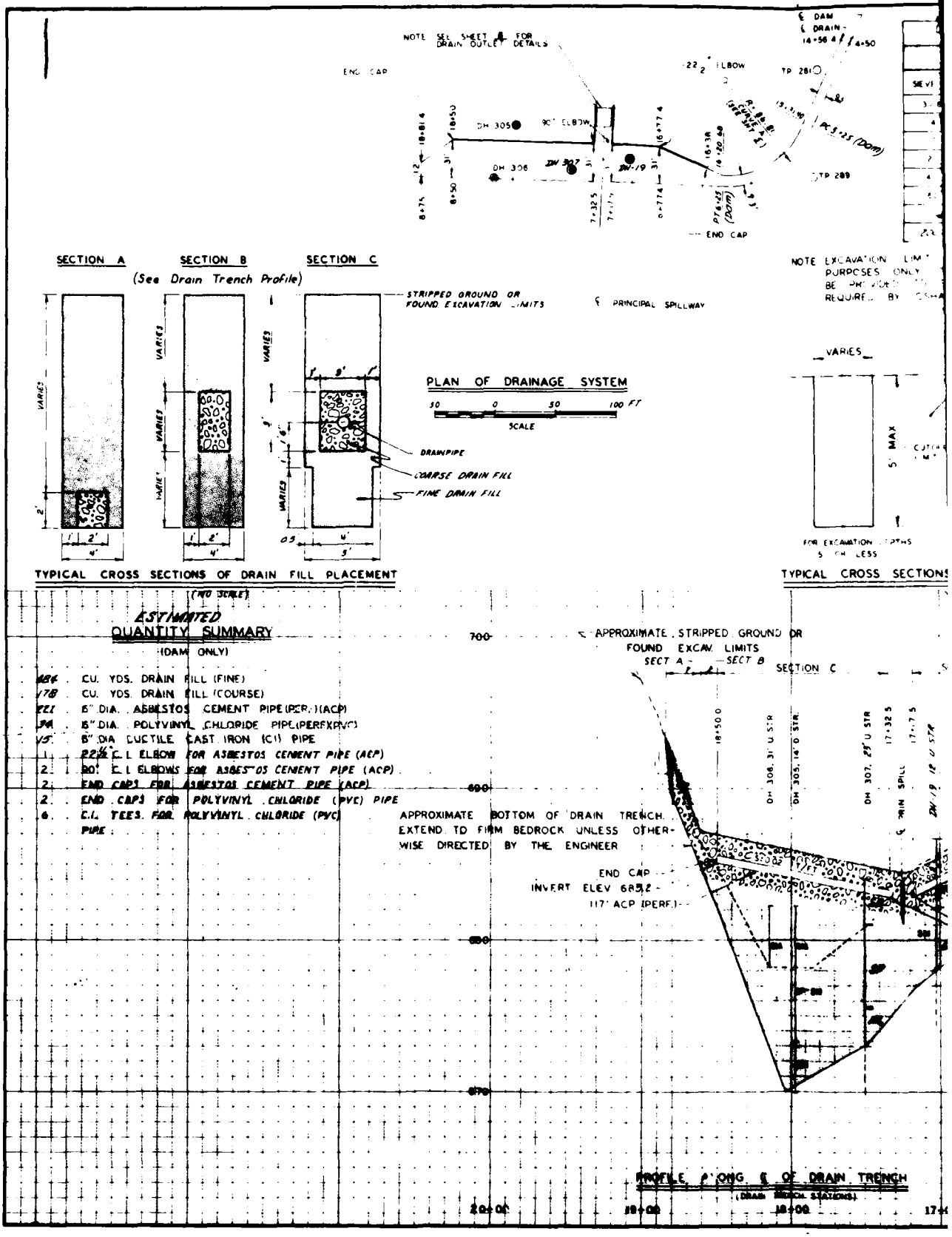
DRAIN TRENCH DETAILS - DAM

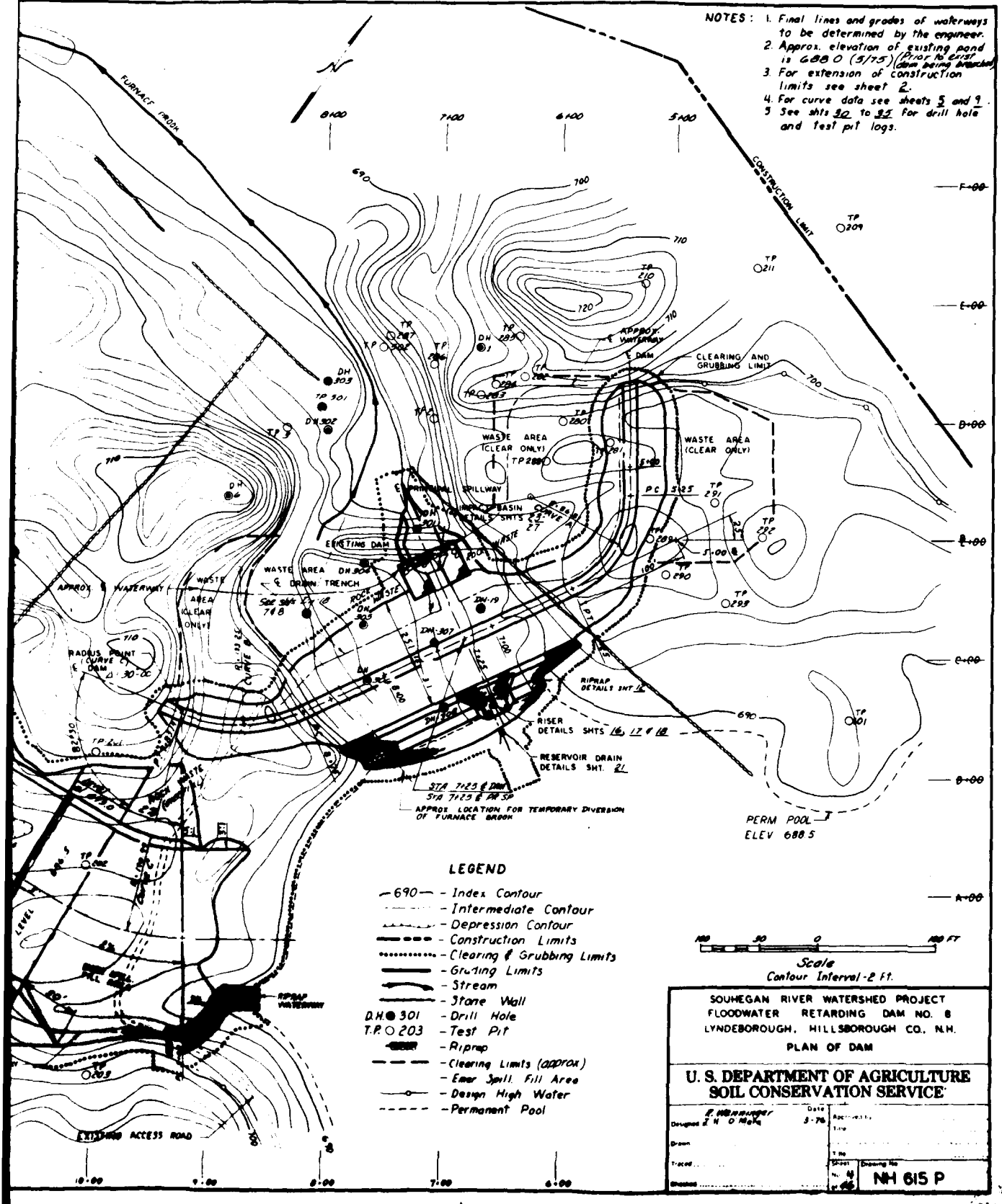
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

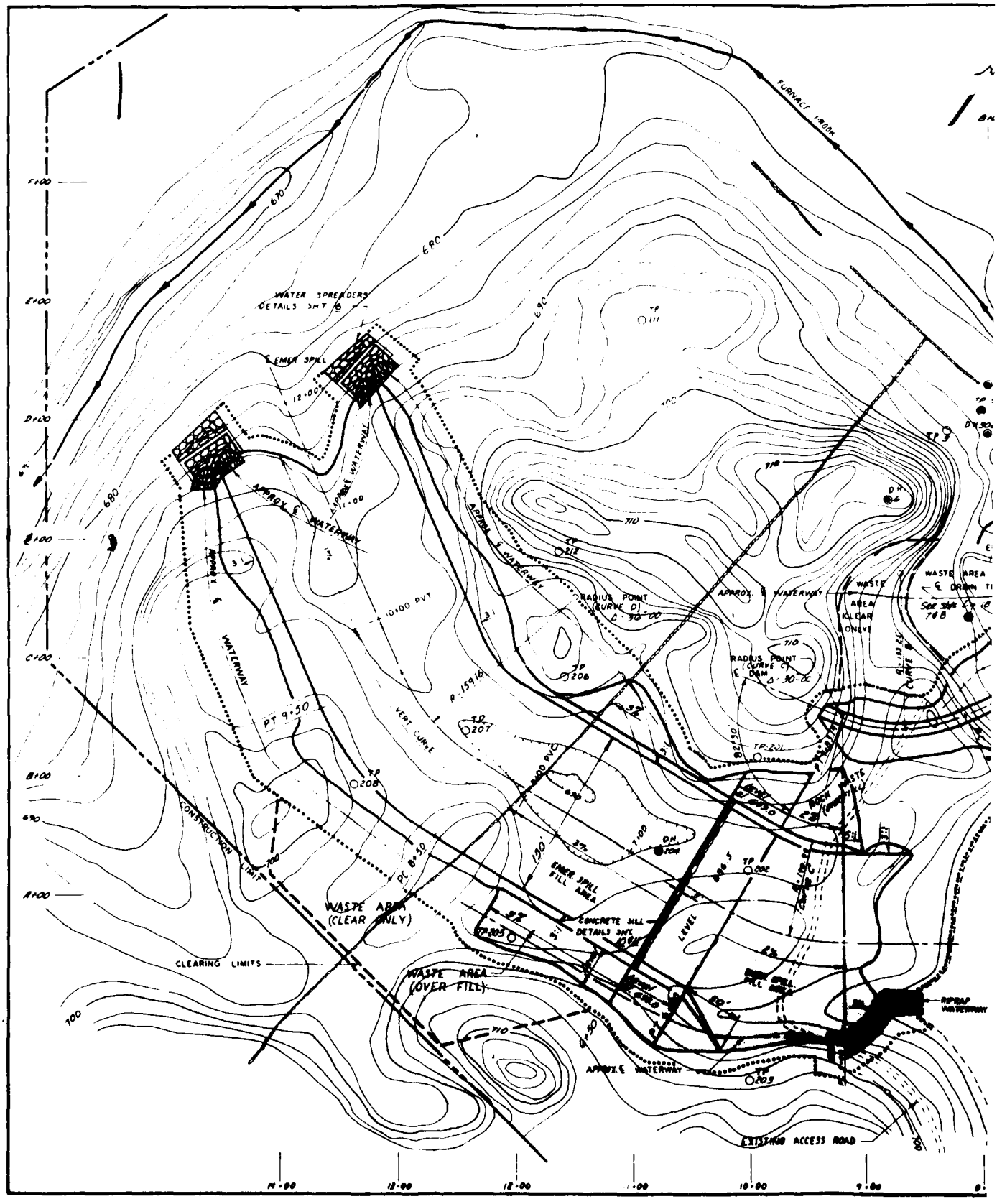
	Date		
Designed J. N. O'Shea	4-75	Approved by	
Drawn R. Webster	4-75	Title	
Traced			
Checked		Sheet No. 7 of 46	Drawing No. NH 615 P

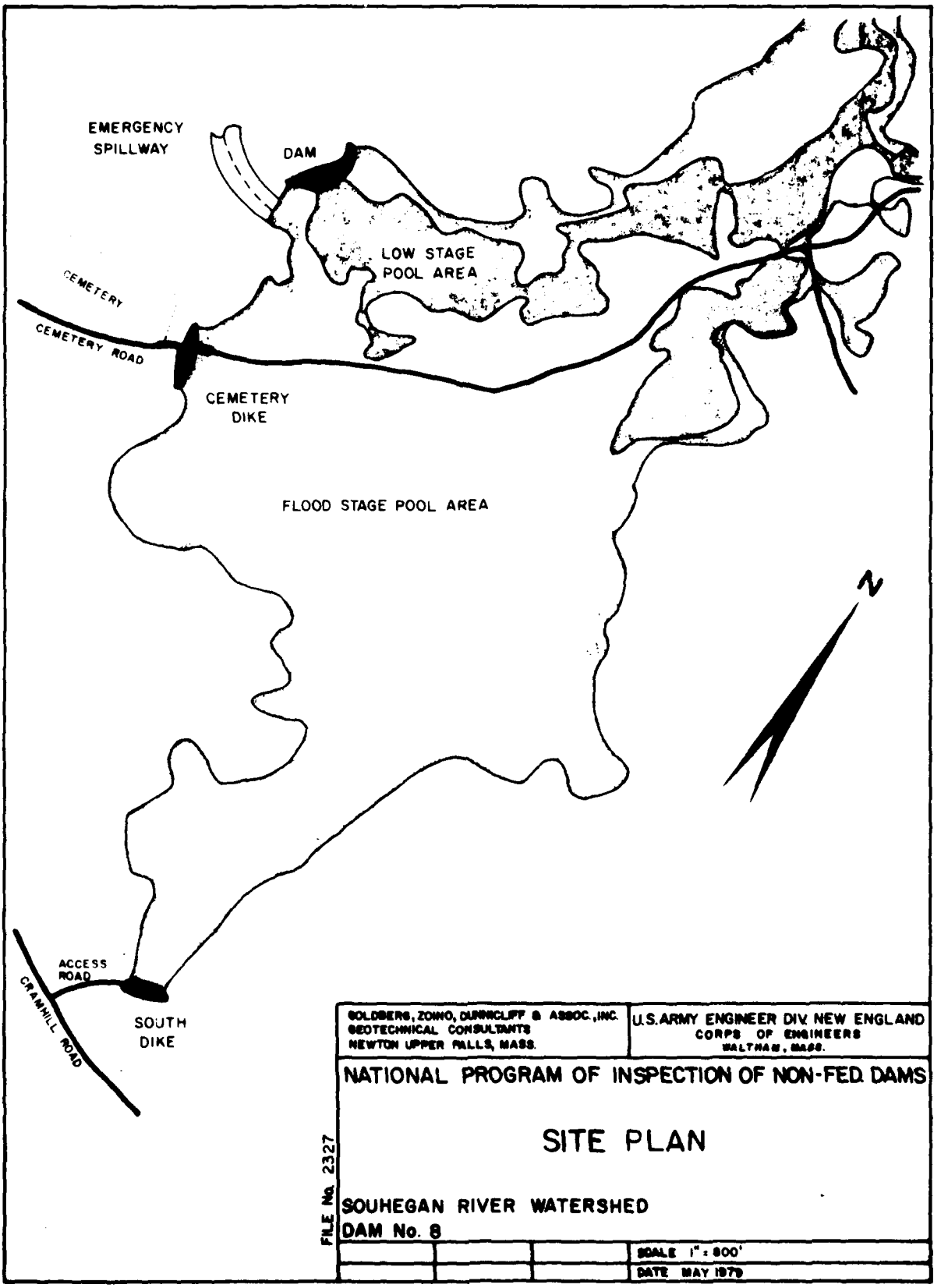
B-4

FORM SCS-316 (NOV. 1966)


NOTE SEE SHEET 8 FOR DRAIN OUTLET DETAILS
END CAP
22½° ELBOW
DH 305
90° ELBOW
DH 306
DH 307
DH-19
TP 288
TP 289
END CAP
SECTION A
SECTION B
(See Drain Trench Profile)
SECTION C
STRIPPED GROUND OR FOUND EXCAVATION LIMITS
℄ PRINCIPAL SPILLWAY
DRAINPIPE
COARSE DRAIN FILL
FINE DRAIN FILL
VARIES
PLAN OF DRAINAGE SYSTEM
50 0 50 100 FT
SCALE
TYPICAL CROSS SECTIONS OF DRAIN FILL PLACEMENT
(NO SCALE)
TYPICAL CROSS SECTIONS
5' MAX
FOR EXCAVATION DEPTHS 5' OR LESS
ESTIMATED
QUANTITY SUMMARY
(DAM ONLY)
486 CU. YDS. DRAIN FILL (FINE)
178 CU. YDS. DRAIN FILL (COURSE)
211 8" DIA. ASBESTOS CEMENT PIPE (PER.) (ACP)
99 8" DIA. POLYVINYL CHLORIDE PIPE (PERF.) (PVC)
15 8" DIA DUCTILE CAST IRON (CI) PIPE
1 22½° C.I. ELBOW FOR ASBESTOS CEMENT PIPE (ACP)
2 90° C.I. ELBOWS FOR ASBESTOS CEMENT PIPE (ACP)
2 END CAPS FOR ASBESTOS CEMENT PIPE (ACP)
2 END CAPS FOR POLYVINYL CHLORIDE (PVC) PIPE
6 C.I. TEES FOR POLYVINYL CHLORIDE (PVC) PIPE
℄ APPROXIMATE STRIPPED GROUND OR FOUND EXCAV. LIMITS
SECT A
SECT B
SECTION C
APPROXIMATE BOTTOM OF DRAIN TRENCH. EXTEND TO FIRM BEDROCK UNLESS OTHERWISE DIRECTED BY THE ENGINEER
END CAP
INVERT ELEV 685.2
117' ACP (PERF.)
700
600
500
DH 306, 31' U STR
DH 305, 14' 0 STR.
DH 307, 25' U STR
℄ PRIN SPILL
PROFILE ALONG ℄ OF DRAIN TRENCH
(DRAIN TRENCH STATIONS)
20+00
19+00
18+00


NOTES: 1. Final lines and grades of waterways to be determined by the engineer.
2. Approx. elevation of existing pond is 688.0 (5/75) (Prior to erosion of dam being breached)
3. For extension of construction limits see sheet 2.
4. For curve data see sheets 5 and 9.
5. See shts 30 to 35 for drill hole and test pit logs.
2
N
FURNACE BROOK
CONSTRUCTION LIMIT
CLEARING AND GRUBBING LIMIT
APPROX. ℄ WATERWAY
℄ DAM
EMERGENCY SPILLWAY
IMPACT BASIN DETAILS SHTS 25-27
EXISTING DAM
℄ DRAIN TRENCH
WASTE AREA (CLEAR ONLY)
WASTE AREA DH-302
ROCK WASTE
RADIUS POINT (CURVE C) ℄ DAM
RIPRAP DETAILS SHT 14
RISER DETAILS SHTS 16, 17 & 18
RESERVOIR DRAIN DETAILS SHT. 21
STA 7+25 ℄ DAM
STA 7+25 ℄ EM SP
APPROX LOCATION FOR TEMPORARY DIVERSION OF FURNACE BROOK
PERM POOL ELEV 688.5
EXISTING ACCESS ROAD
RIPRAP WATERWAY
LEGEND
690 - Index Contour
- Intermediate Contour
- Depression Contour
- Construction Limits
- Clearing & Grubbing Limits
- Grubbing Limits
- Stream
- Stone Wall
D.H. 301 - Drill Hole
T.P. 203 - Test Pit
- Riprap
- Clearing Limits (approx)
- Emer Spill. Fill Area
- Design High Water
- Permanent Pool
100 50 0 100 FT
Scale
Contour Interval - 2 Ft.
SOUHEGAN RIVER WATERSHED PROJECT
FLOODWATER RETARDING DAM NO. 8
LYNDEBOROUGH, HILLSBOROUGH CO., N.H.
PLAN OF DAM
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NH 615 P


WATER SPREADERS
DETAILS SHT 6
EMER SPILL
APPROX ℄ WATERWAY
10+00 PVT
PT 9+50
VERT CURVE
CONSTRUCTION LIMIT
WASTE AREA
(CLEAR ONLY)
CLEARING LIMITS
WASTE AREA
(OVER FILL)
EMER SPILL
FILL AREA
CONCRETE SILL
DETAILS SHT
LEVEL
RADIUS POINT
(CURVE D)
RADIUS POINT
(CURVE C)
APPROX ℄ WATERWAY
EXISTING ACCESS ROAD
RIPRAP
WATERWAY
FURNACE IRON



GOLDBERG, ZOINO, DUNNICLIFF & ASSOC., INC.
GEOTECHNICAL CONSULTANTS
NEWTON UPPER FALLS, MASS.

U.S. ARMY ENGINEER DIV. NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

SITE PLAN

SOUHEGAN RIVER WATERSHED
DAM No. 8

FILE No. 2327

SCALE 1" = 800'
DATE MAY 1979

APPENDIX B

CHECK LISTS FOR VISUAL INSPECTION		
AREA EVALUATED	BY	CONDITION & REMARKS
Rusting or staining of concrete	PR	None noted
Visible reinforcing		None noted
Efflorescence		None noted
Chainlink fence		No deficiencies noted
E. Emergency Spillway Sill		
Spalling		Slight spalling on exposed surface at right end.
Erosion		None noted
Cracking		None noted
Efflorescence	PR	None noted

CHECK LISTS FOR VISUAL INSPECTION

AREA EVALUATED	BY	CONDITION & REMARKS
APPURTENANT STRUCTURES		
A. Drop Inlet Service Spillway Structure	PR	
Condition of concrete		Good
Spalling		None noted
Erosion		None noted
Cracking		None noted
Rusting or staining of concrete		None noted
Visible reinforcing		None noted
Efflorescence		None noted
Trash racks		
Upper stage trash racks		No deficiencies noted
Lower stage trash racks		No deficiencies noted
Bench stand		No deficiencies noted
B. Reservoir Discharge Conduit		Submerged, could not be observed
C. Outlet Conduit (primary spillway)		No deficiencies noted with the exception of missing preformed joint filler.
D. Impact Basin		
Condition of concrete		Good
Spalling		None noted
Erosion		None noted
Cracking	PR	None noted

SOUHEGAN RIVER WATERSHED DAM NO. 8 NH 00474
Lyndeborough, New Hampshire May 14, 1979

CHECK LISTS FOR VISUAL INSPECTION		
AREA EVALUATED	BY	CONDITION & REMARKS
SOUTH DIKE		
Crest Elevation	JMH	703.0 ft.
Current Pool Elevation		Not applicable
Maximum Impoundment to Date		Not applicable
Surface Cracks		None
Pavement Condition		Not applicable
Movement or Settlement of Crest		None
Lateral Movement		None
Vertical Alignment		Good
Horizontal Alignment		Good
Condition at Abutment and at Concrete Structures		Good
Indications of Movement of Structural Items on Slopes		None
Trepassing on Slopes		Small erosion gullies in downstream slope 2 to 3" deep
Sloughing or Erosion of Slopes of Abutments		None
Rock Slope Protection - Riprap Failures		None
Unusual Movement or Cracking at or Near Toes		None
Unusual Embankment or Downstream Seepage		None
Piping or Boils		None
Foundation Drainage Features		None
Toe Drains		None
Instrumentation System	JMH	None

SOUHEGAN RIVER WATERSHED DAM NO. 8 — NH 00474
Lyndeborough, New Hampshire — May 14, 1979

CHECK LISTS FOR VISUAL INSPECTION		
AREA EVALUATED	BY	CONDITION & REMARKS
CEMETERY DIKE		
Crest Elevation	JMH	703.0 ft.
Current Pool Elevation		Not applicable
Maximum Impoundment to Date		Not applicable
Surface Cracks		None
Pavement Condition		Not applicable
Movement or Settlement of Crest		None
Lateral Movement		None
Vertical Alignment		Good
Horizontal Alignment		Good
Condition at Abutment and at Concrete Structures		Good
Indications of Movement of Structural Items on Slopes		None
Trepassing on Slopes		None
Sloughing or Erosion of Slopes of Abutments		None
Rock Slope Protection - Riprap Failures		None
Unusual Movement or Cracking at or Near Toes		None
Unusual Embankment or Downstream Seepage		ne
Piping or Boils		None
Foundation Drainage Features		Trench drain functioning with very slow seepage (1-2 gpm)
Toe Drains		None
Instrumentation System	JMH	None

SOUHEGAN RIVER WATERSHED DAM NO. 8 — NH 00474
Lyndeborough, New Hampshire — May 14, 1979

CHECK LISTS FOR VISUAL INSPECTION		
AREA EVALUATED	BY	CONDITION & REMARKS
DAM EMBANKMENT		
Crest Elevation	JMH	703.0 ft.
Current Pool Elevation		689 ± ft.
Maximum Impoundment to Date		No data
Surface Cracks		None
Pavement Condition		Not applicable
Movement or Settlement of Crest		None
Lateral Movement		None
Vertical Alignment		Good
Horizontal Alignment		Good
Condition at Abutment and at Concrete Structures		Good
Indications of Movement of Structural Items on Slopes		None
Trespassing on Slopes		Tire ruts 6" on downstream right abutment
Sloughing or Erosion of Slopes of Abutments		Minor erosion just above outlet structure on downstream slope
Rock Slope Protection - Riprap Failures		None - Upstream slope good
Unusual Movement or Cracking at or Near Toes		None
Unusual Embankment or Downstream Seepage		Toe drains submerged
Piping or Boils		None
Foundation Drainage Features		Toe drains submerged
Toe Drains		Submerged
Instrumentation System	JMH	None

INSPECTION TEAM ORGANIZATION

Date: May 14, 1979

Project: NH 00474
SOUHEGAN RIVER WATERSHED DAM NO. 8
Lyndeborough, New Hampshire
NHWRB 147.28

Weather: Overcast, drizzle, cool

INSPECTION TEAM

Nicholas A. Campagna	Goldberg, Zoino, Dunnicliff & Assoc. (GZD)	Team Captain
William S. Zoino	GZD	Soils
M. Daniel Gordon	GZD	Soils
Jeffrey M. Hardin	GZD	Soils
Paul Razgha	Andrew Christo, Engineers, Inc., (ACE)	Structures
Carl Razgha	ACE	Structures
Tom Gooch	Resource Analysis, Inc. (RAI)	Hydrology
Robert Fitzgerald	RAI	Hydrology

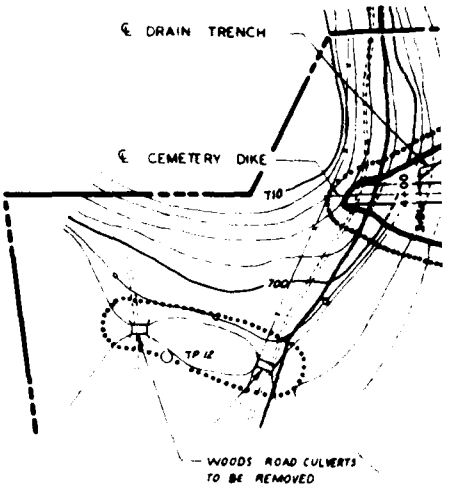
Owner's Representative Present:

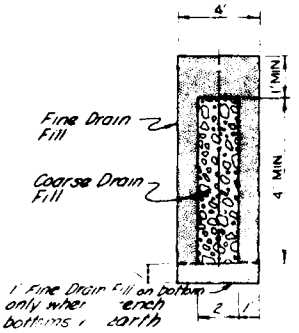
Gary Kerr - New Hampshire Water Resources Board

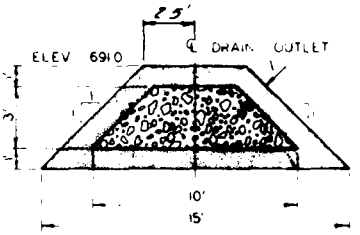
CONSTRUCTION DETAILS

1. For drain fill requirements see table on sht. 7.
2. For earth fill & bedding requirements see sht 6.
3. Extend riprap 1 Ft laterally beyond drain fill at drain outlet.
4. Excavation limits are approximate and will be adjusted in accordance with conditions encountered.
5. Excavated surfaces for woods road culverts shall be left in a neat presentable condition and graded to provide positive drainage. Bottom width and side slopes of excavated surfaces shall be a minimum of 10' wide and 3 horizontal to 1 vertical respectively.
6. Rock exposed in the bottom of the Cutoff Trench and Drain Trench shall be thoroughly cleaned and shall be inspected by the Engineer prior to placement of fill.
7. Rock Riprap shall be equipment placed and shall be well graded from a min size of 6" to a max size of 18" with at least 50% ≥ 12"

see sht 3 for cont of Construction Limits

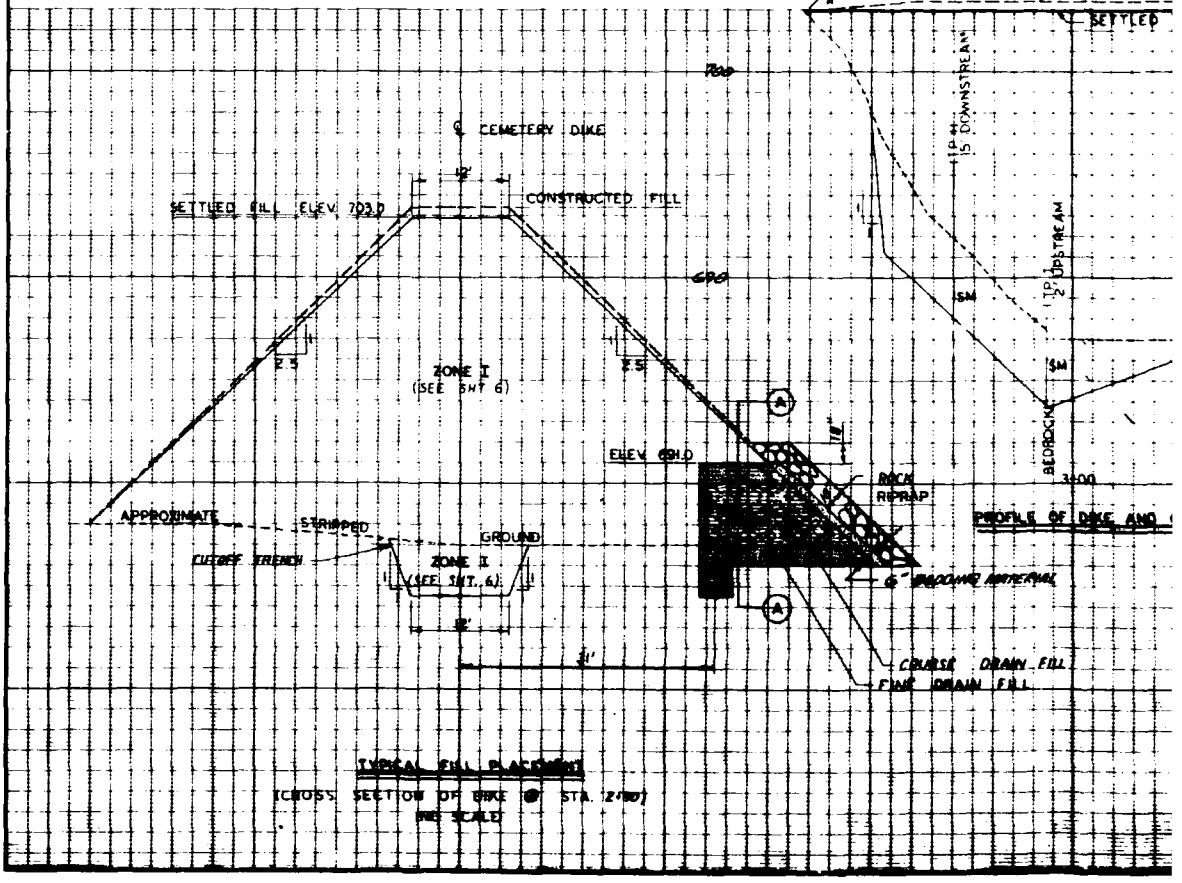




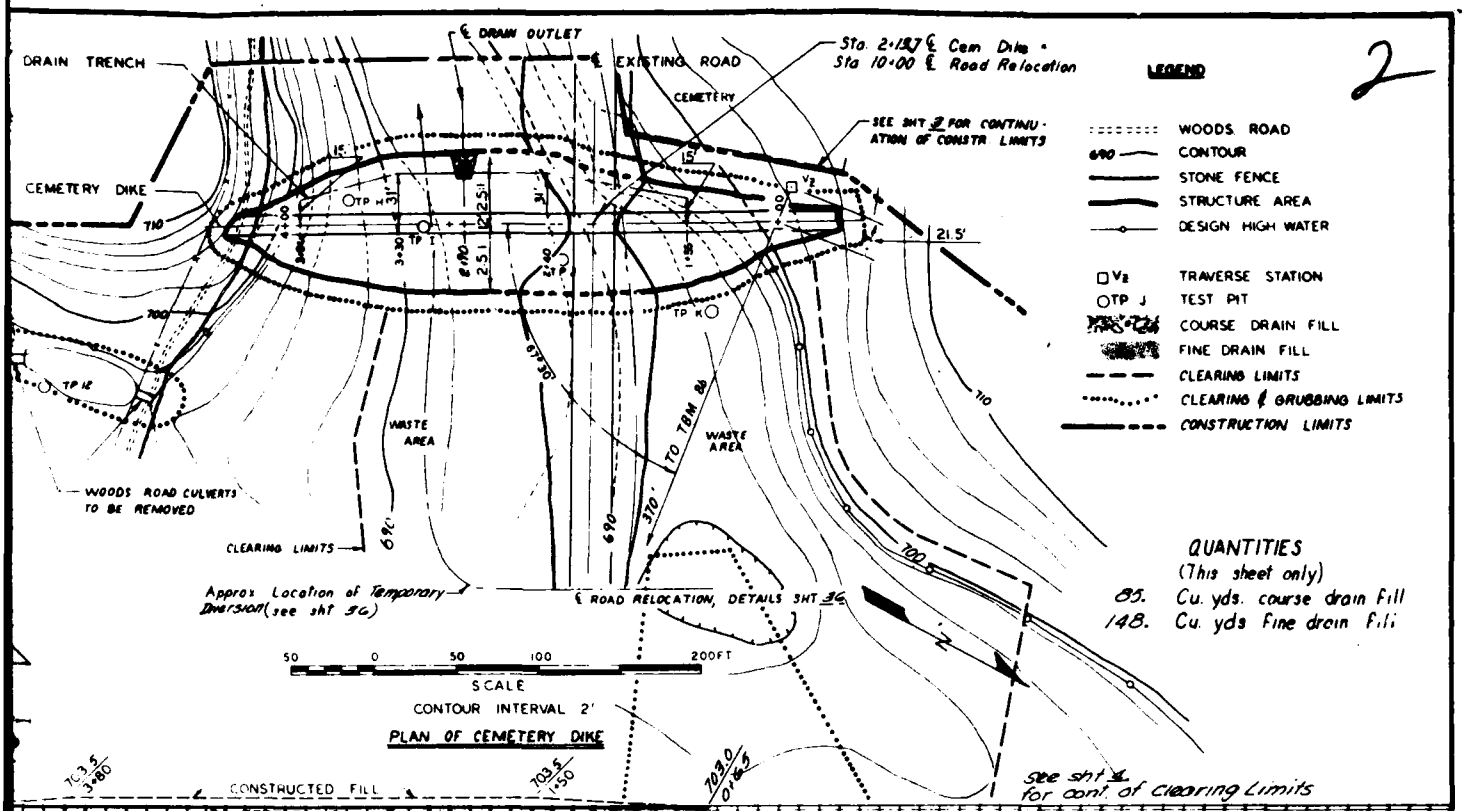


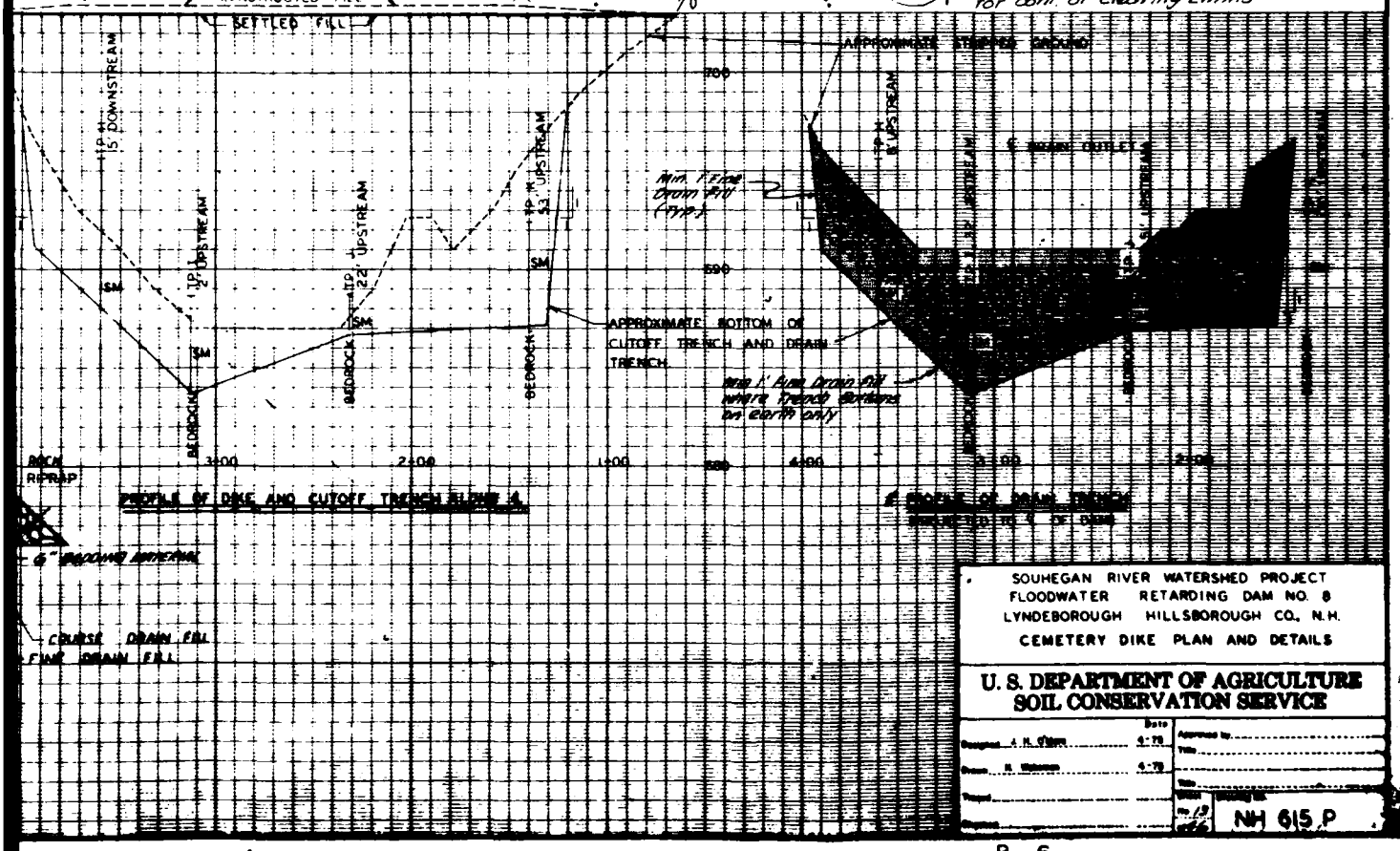
TYPICAL SECTION OF DRAIN FILL PLACEMENT
(NO SCALE)

SECTION AA
(NO SCALE)



TYPICAL FILL PLACEMENT
(CROSS SECTION OF DIKE @ STA. 2+80)
(NO SCALE)

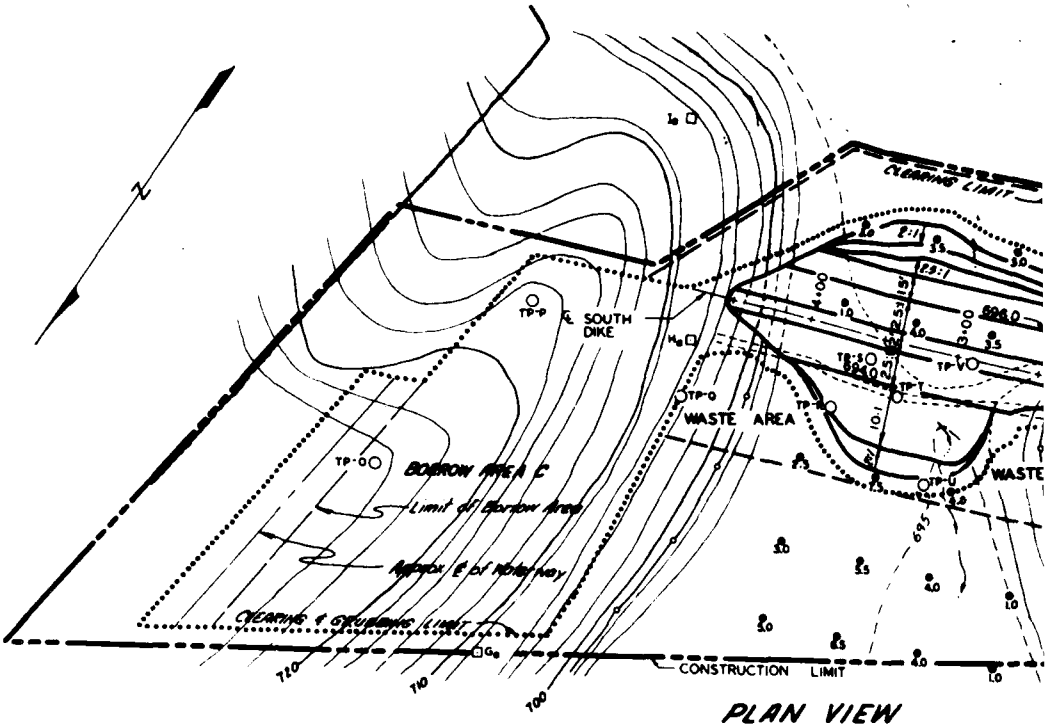




SOUHEGAN RIVER WATERSHED PROJECT
FLOODWATER RETARDING DAM NO. 8
LYNDEBOROUGH HILLSBOROUGH CO., N.H.
CEMETERY DIKE PLAN AND DETAILS

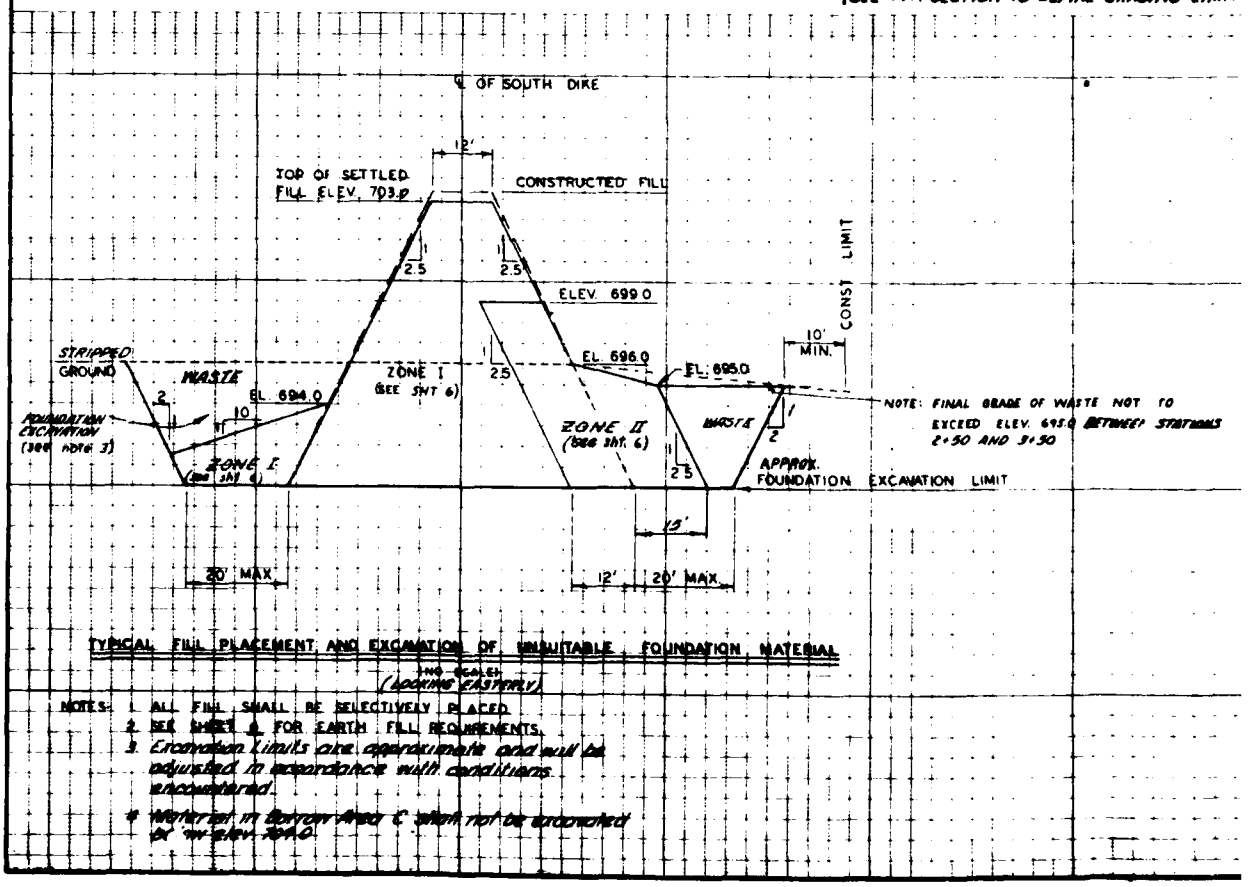
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

NH 615 P



PLAN VIEW

(SEE TYP. SECTION TO DEFINE GRADING LIMIT

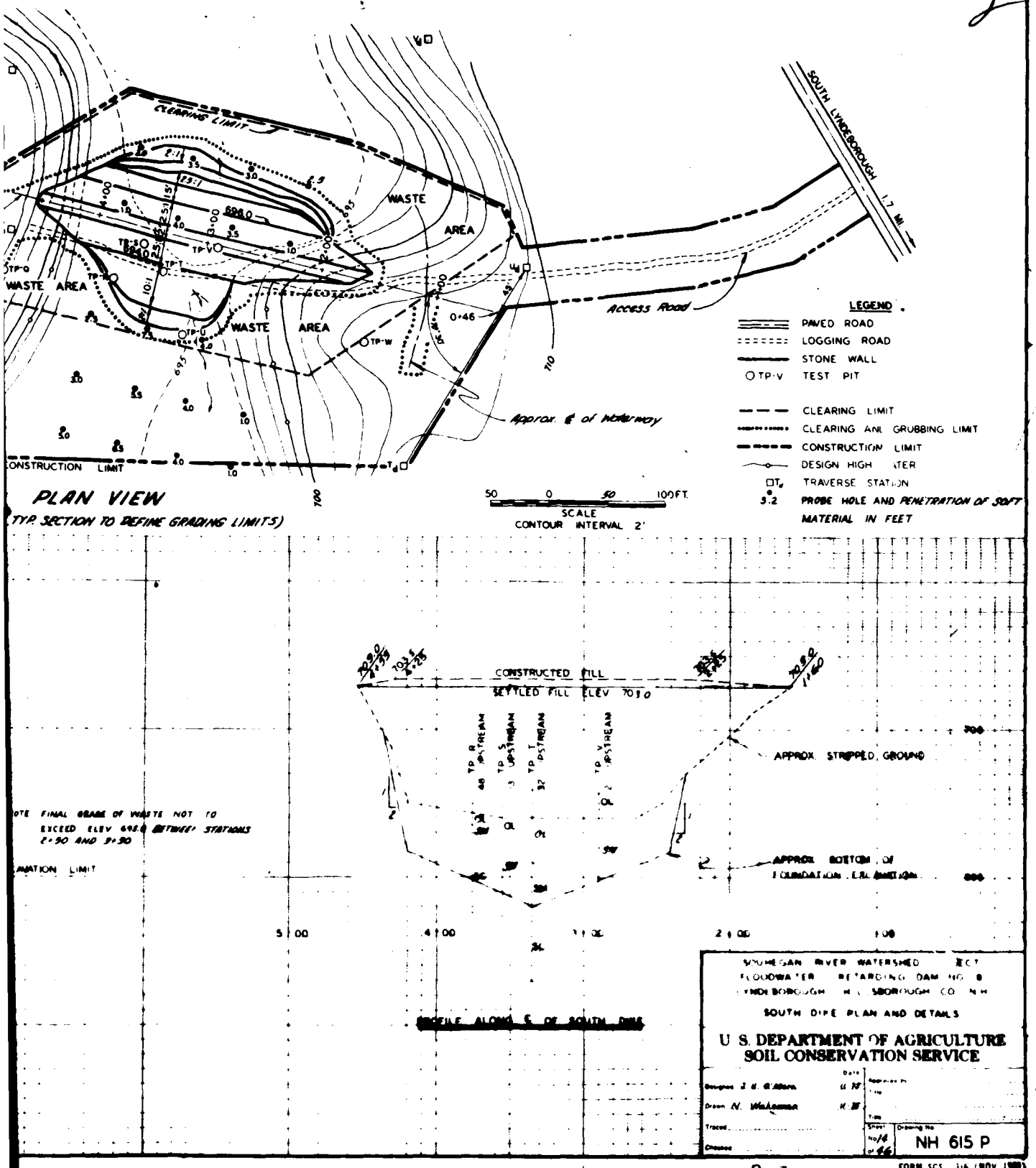


TYPICAL FILL PLACEMENT AND EXCAVATION OF UNSUITABLE FOUNDATION MATERIAL

(NO SCALE)

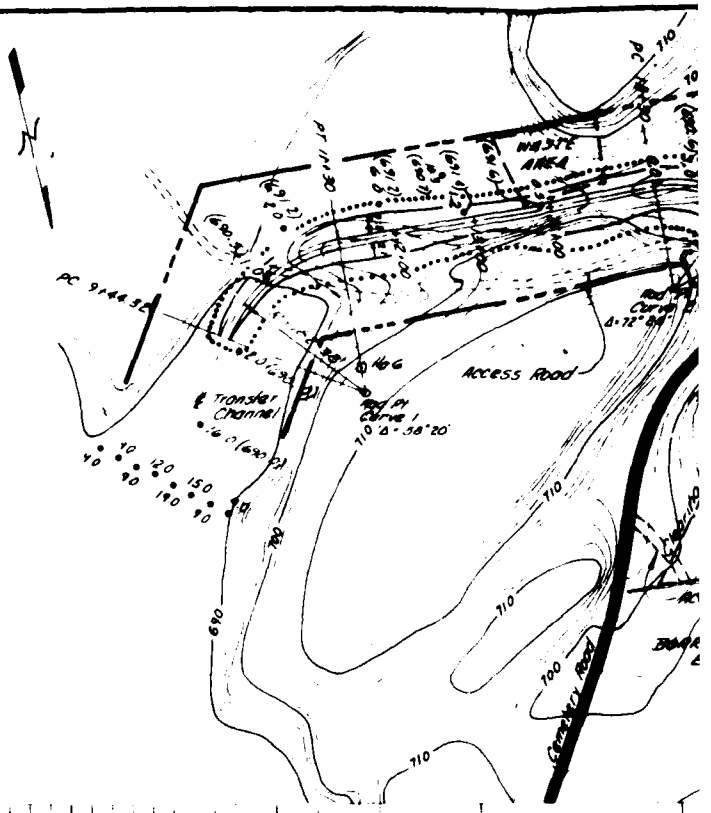
(LOOKING EASTERLY)

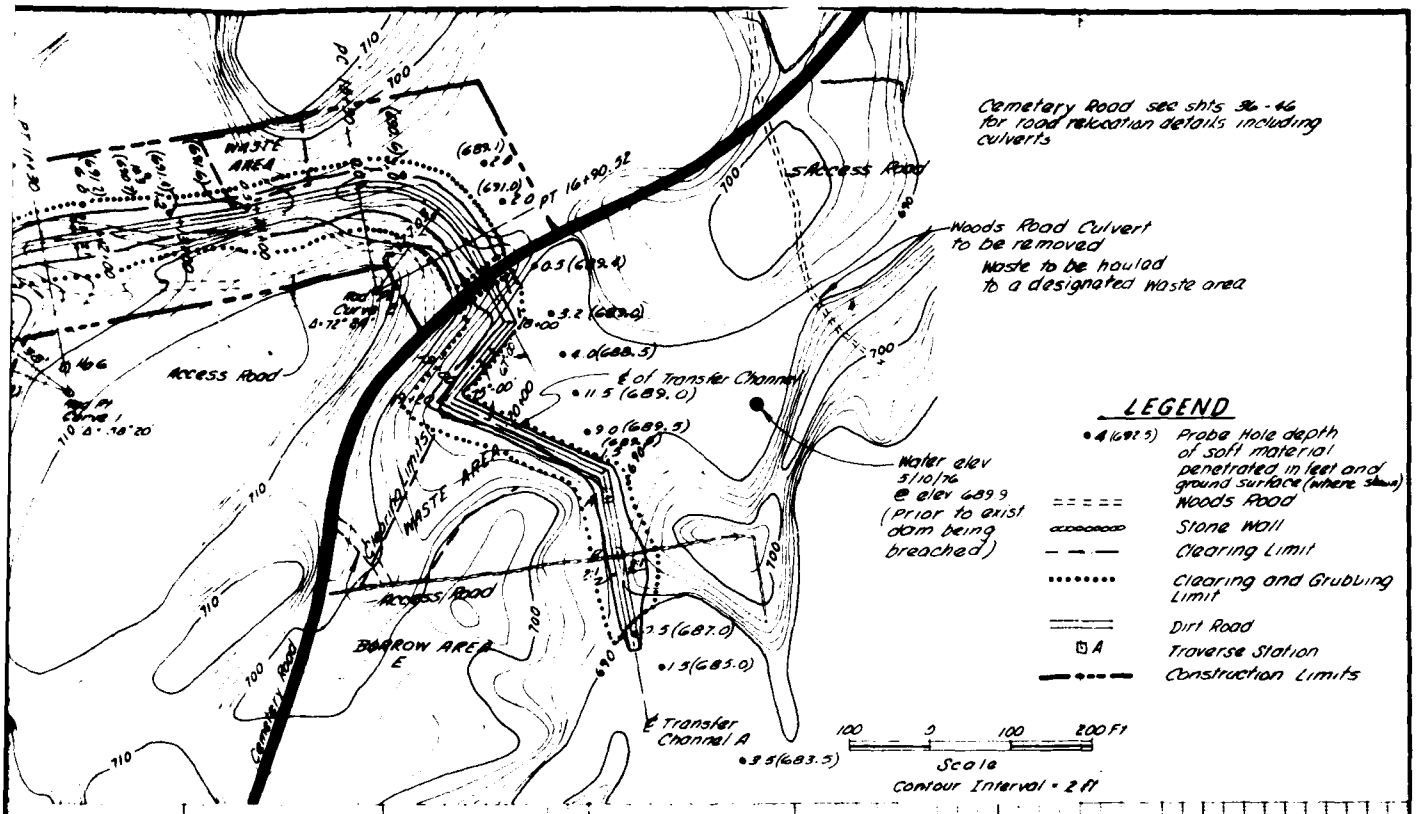
NOTES:
1. ALL FILL SHALL BE SELECTIVELY PLACED.
2. SEE SHEET 6 FOR EARTH FILL REQUIREMENTS.
3. Excavation limits are approximate and will be adjusted in accordance with conditions encountered.
4. Material in Borrow Area C which not be excavated at or above elev. 694.0.

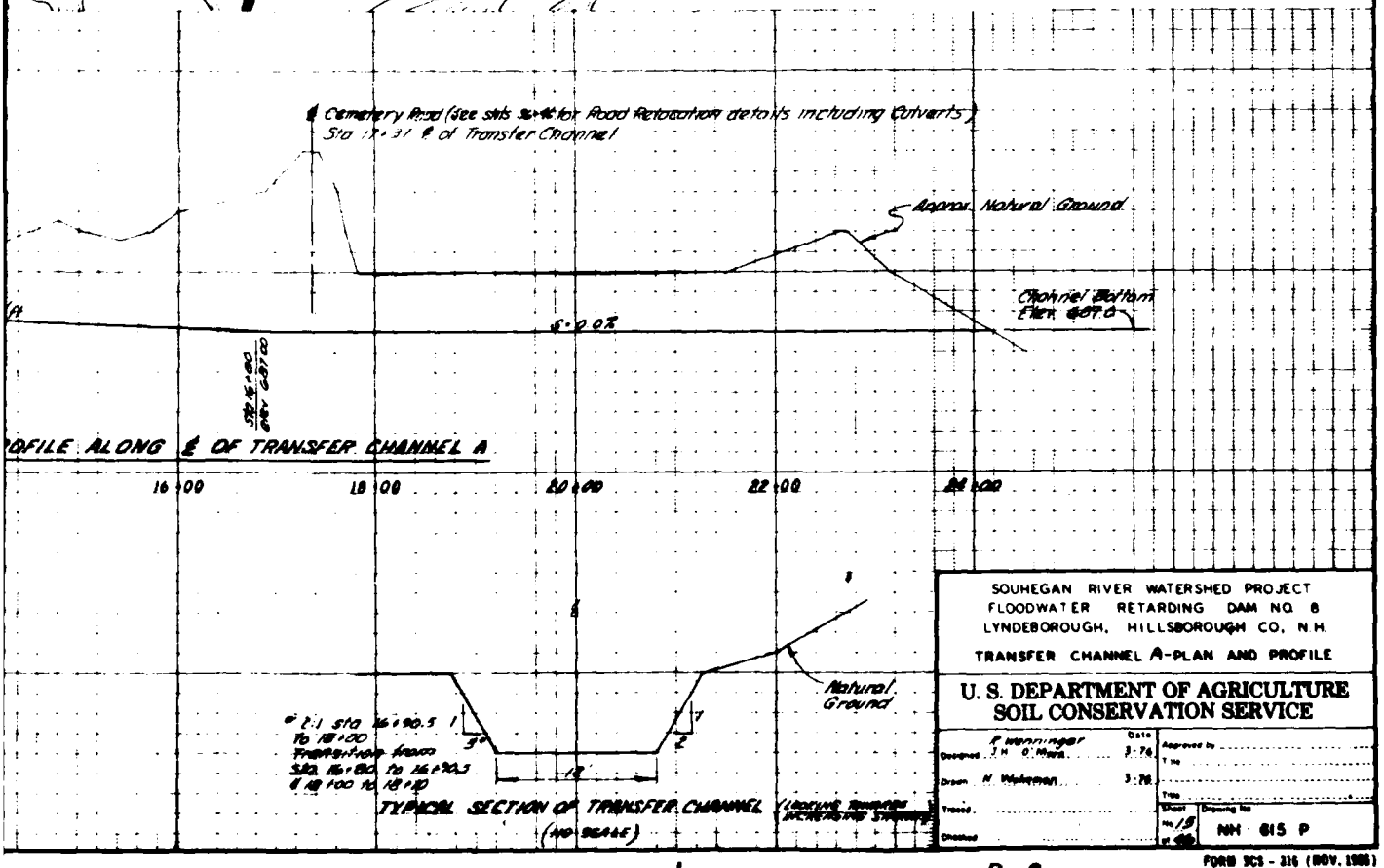

CLEARING LIMIT
WASTE AREA
WASTE AREA
WASTE AREA
SOUTH LYNDEBOROUGH 1.7 MI
Access Road
Approx. ℄ of Waterway
CONSTRUCTION LIMIT
TP-O
TP-U
TP-V
TP-W
TP-T
0+46
LEGEND
PAVED ROAD
LOGGING ROAD
STONE WALL
TP-V TEST PIT
CLEARING LIMIT
CLEARING AND GRUBBING LIMIT
CONSTRUCTION LIMIT
DESIGN HIGH WATER
TRAVERSE STATION
PROBE HOLE AND PENETRATION OF SOFT MATERIAL IN FEET
50 0 50 100FT.
SCALE
CONTOUR INTERVAL 2'
PLAN VIEW
(TYP. SECTION TO DEFINE GRADING LIMITS)
CONSTRUCTED FILL
SETTLED FILL ELEV 703.0
APPROX. STRIPPED GROUND
APPROX. BOTTOM OF FOUNDATION EXCAVATION
TP R DSTREAM
TP S UPSTREAM
TP T DSTREAM
TP V UPSTREAM
5+00
4+00
3+00
2+00
1+00
PROFILE ALONG ℄ OF SOUTH DIKE
NOTE FINAL GRADE OF WASTE NOT TO EXCEED ELEV 698.0 BETWEEN STATIONS 2+90 AND 3+90
EXCAVATION LIMIT
MERRIMACK RIVER WATERSHED
FLOODWATER RETARDING DAM NO. 8
LYNDEBOROUGH & WILTON COUNTIES, N.H.
SOUTH DIKE PLAN AND DETAILS
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
Designed J. A. Gibbons
Drawn N. Wadsworth
Traced
Checked
Sheet No. 14 of 46
Drawing No. NH 615 P
B 7
FORM SCS 316 (NOV 1980)

TRANSFER CHANNEL CURVE DATA

	Δ	R	D	L	STA	CHORD	DFF Δ
CURVE 1	58°20'	182.38'	31°25'	185.68'	PC 9+99.32	-	-
					9+50	5.68	0°53'
					9+75	24.98	4°49'
					10+00		8°45'
					10+25		12°41'
					10+50		16°35'
					10+75		20°31'
					11+00		24°27'
					11+25		28°23'
					PT 11+30	5.00	29°10'
CURVE 2	72°24'	127°03'	45°06'	160.52'	PC 15+30	-	-
					15+50	19.99	4°30'
					15+75	24.96	10°09'
					16+00		15°47'
					16+25		21°25'
					16+50		27°09'
					16+75		32°42'
					PT 16+90.32	15.51	36°12'







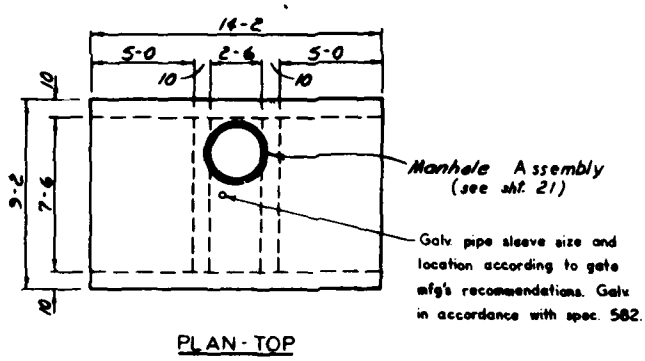
SOUHEGAN RIVER WATERSHED PROJECT
FLOODWATER RETARDING DAM NO. 8
LYNDEBOROUGH, HILLSBOROUGH CO., N.H.

TRANSFER CHANNEL A-PLAN AND PROFILE

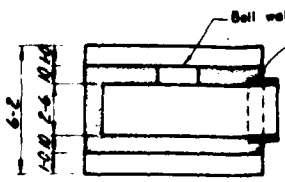
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed	F. Manninger, T.H. O'Mara	3-76
Drawn	N. Wakeman	3-76
Traced		
Checked		
Approved by		
Title		
Title		
Sheet No.	19	
Drawing No.	NH 615 P	

FORM SCS - 316 (NOV. 1968)

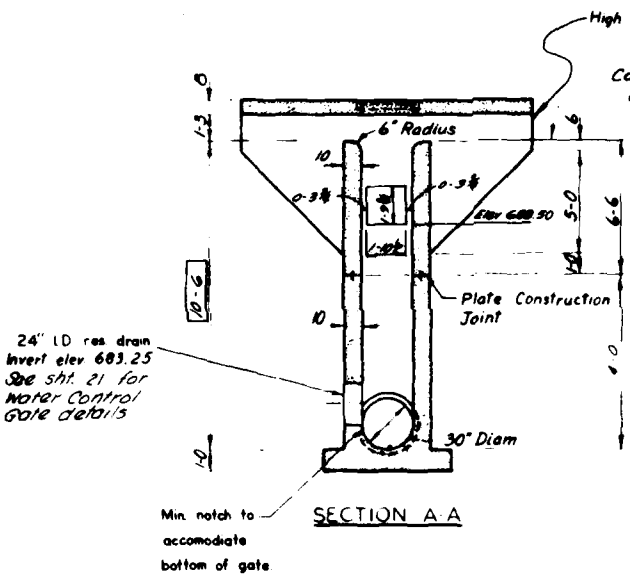


PLAN - TOP

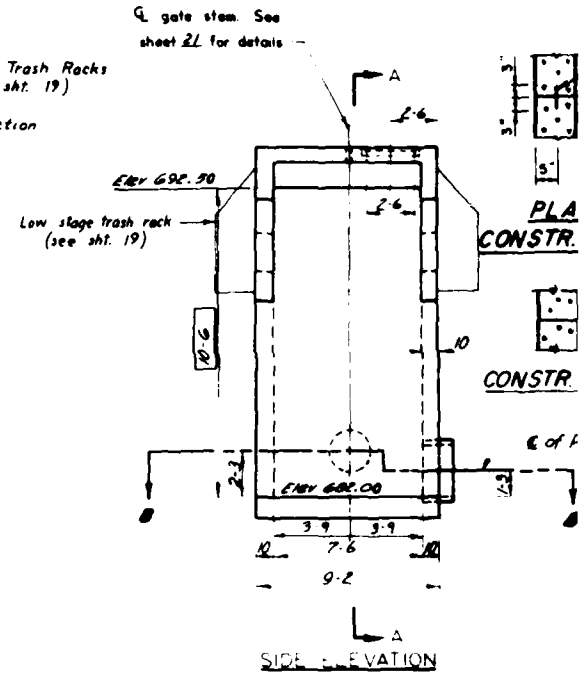


SECTION B-B

1/4" x 6" Co
to conform
Continuous
Splices Sha
1 Butt We
2 Lapped
3 Lapped



SECTION A-A



SIDE ELEVATION

PLA
CONSTR.
CONSTR.

QUANTITIES

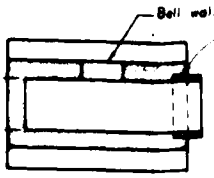
Steel:

#4 Bars	350-0 Lin Ft	234	Lbs.
#5 Bars	1043-2 Lin Ft	1922	Lbs.
#8 Bars	166-6 Lin. Ft.	445	Lbs.
	Total	2601	Lbs.

Length of #5 Bars = (1,819-6) + (Length of Bars R1, R2, R3, R4 and R5).

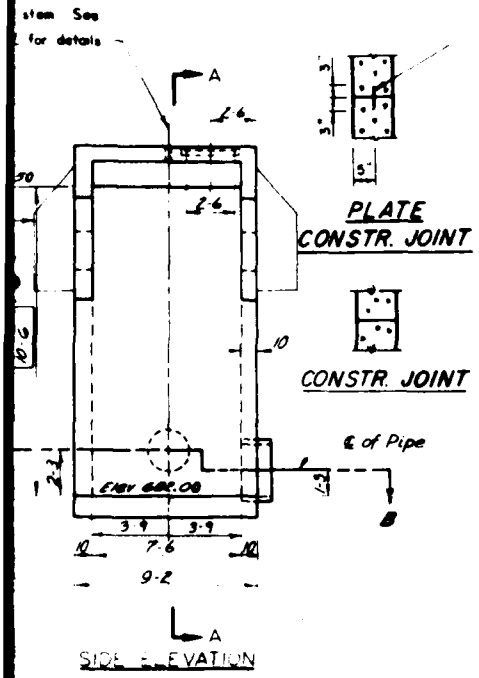
Total Concrete = 16.0 Cu. Yds.

STANDARD COVERED RISER	
DESIGN CONSTANTS: f'_c = 4000 psi, n = 8	f_c = 1680 psi, f_s = 20,000 psi
STANDARD DWG. NO.	ES-3030-1510E
DATE 8-65	SHEET 1 OF 5



SECTION B-B

1/4 x 6" Carbon steel plate to conform to Spec 58
Continuous Thru Constr Joint
Splices Shall Be Either
1 Butt Welded
2 Lapped 3" And Bolted
3 Lapped 3" And Fillet Welded



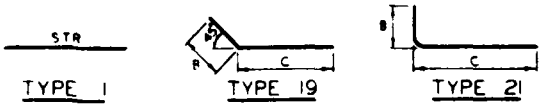
SIDE ELEVATION

STEEL SCHEDULE

Mark	Size	Quantity	Length	Type	B	C	Total Length
B1	#5	10	5-9	1			57-6
B2	#5	7	8-9	1			61-3
B3	#8	18	9-3	21	3-0	6-3	166-6
B4	#5	6	8-9	1			32-6
B5	#5	1	8-0	1			8-0
B6	#5	9	5-9	1			51-9
B7	#5	2	2-3	1			4-6
B8	#5	5	7-3	21	1-0	6-3	36-3
B9	#5	17	7-3	21	1-0	6-3	123-3
B10	#5	8	8-3	1			66-0
B11	#5	4	3-3	1			13-0
B12	#5	3	2-9	1			8-3
B13	#5	3	2-9	1			8-3
B14	#5	8	5-9	21	0-6	3-3	46-0
B15	#5	12	8-0	21	2-9	3-3	96-0

Mark	Size	Quantity	Length	Type	B	C	Total Length
T1	#5	18	6-0	1			108-0
T2	#5	6	8-0	1			48-0
T3	#5	4	4-9	1			19-0
T4	#5	4	3-6	1			14-0
T5	#5	4	2-3	1			9-0
T6	#5	4	9-0	19	2-0	7-0	36-0
T7	#5	12	8-3	1			99-0
T8	#5	2	3-3	1			6-6
T9	#5	2	5-9	1			11-6
T10	#5	2	10-9	1			21-6
T11	#5	2	13-3	1			26-6
T12	#5	14	6-3	1			87-6
T13	#5	6	8-0	1			48-0
T14	#5	4	6-0	1			24-0
T15	#5	4	4-9	1			19-0
T16	#5	4	3-6	1			14-0
T17	#5	4	2-3	1			9-0
T18	#5	4	9-0	19	2-0	7-0	36-0
T19	#5	24	8-0	21	2-3	5-3	192-0
T20	#5	2	3-3	1			6-6
T21	#5	2	5-9	1			11-6
T22	#5	2	8-3	1			16-6
T23	#5	2	10-9	1			21-6
T24	#5	2	13-3	1			26-6
T25	#5	4	13-9	1			55-0
T26	#5	4	13-9	1			55-0
T27	#4	14	8-3	1			115-6
T28	#3	2	4-9	1			9-6
T29	#4	7	13-9	1			96-3
T30	#4	4	5-3	1			21-0
T31	#5	24	6-9	21	1-6	5-3	162-0
T32	#5	2	6-6	21	1-6	5-0	13-0
T33	#5	2	2-6	21	1-6	1-0	5-0
T34	#4	7	13-9	1			96-3
T35	#4	4	5-3	1			21-0

BAR TYPES



Notes.
1. Bar dimensions are out to out of bar
2. Radius of bends equals 3 bar diameters for sizes equal to or less than #7.
3. The 2" and 3" dimensions from face of concrete to steel are clear distances.

0 2 4 6
Scale in Feet

Notes:
1. For Manhole Cover and Frame, See Detail Sheet 21
2. For Spigot Wall Fitting, See Detail Sheet 21
3. For Trash Rack, Grating, Sleeves and Bolts, See Detail Sheet 12
4. For Construction Joints, See Detail
5. For bell wall fitting, see sheet 21.

Ft. — — — 294 Lbs.
Ft. — — — 1922 Lbs.
Ft. — — — 445 Lbs.
tal — — — 2601 Lbs.
of Bars R1, R2, R3, R4 and R5).
— — — — = 76.0 Cu Yds.

SOUHEGAN RIVER WATERSHED PROJECT
FLOODWATER RETARDING DAM NO 8
LYNDEBOROUGH, HILLSBOROUGH CO., N.H.

RISER DETAILS

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Adapted — Date 4/62
Drawn
Traced
Checked
Approved by
Title
Title
Sheet No. 16
Drawing No. NH 615 P

TP-2, STAT. B/L+95, 7+10; ELEV. 685.7 11/5/64

0. - 2.3 Cobbles, gravelly w/fines, sand and boulders; mottled blue-gray and yellow-brown color, poorly graded, firm, 10% fines, 20% sands, 20% gravels, 20% small cobbles; 15% large cobbles, 15% boulders (maximum size: 2.5 x 2.0 x 1.0).
GLACIAL OUTWASH

2.3 - 6.0 Bedrock
BIOTITE gneiss, very fractured, angular; the pieces of rock are hard, iron stained w/sand, clay and some organic material in fractures. Fractures become fewer and tighter with depth.

TP-3, STAT. B/L+90, 8+30; ELEV. 690.4 11/5/64

0.0 - 3.3 SM - Sand, silty w/cobbles, and boulders; olive-gray color mottled w/yellow-brown, poorly graded, firm, wet, moderately permeable, 25% fines, 30% sands, 15% gravels, 10% small cobbles, 5% large cobbles, 20% boulders (maximum size: 3. x 3.0 x 2.5).
GLACIAL OUTWASH

3.3 - 6.0 Bedrock
Quartz diorite, fractured, iron-stained, angular; the depth to bedrock varies from 3.3 to 6.0 in the pit. Six (6) inches of highly fractured rock was removed from the middle of the pit.

TP-7, Downstream of Borrow Area C, ELEV. 707.1 10/30/64

0.0 - 0.5 Topsoil

0. - 7. GM-GP — Gravel, sandy w/silt, cobbles and boulders; yellow-brown color, loose, moist, rapidly permeable; 10% fines; 25% sands; 30% gravels; 10% small cobbles; 10% large cobbles; 5% boulders (maximum size: 3.[illegible] x [illegible] x [illegible]).

7.[illegible] - 13.[illegible] SP — Sand, gravelly w/cobbles; yellow-brown color, poorly graded, [illegible], moist, rapidly permeable. 50% fine sand; 25% medium and coarse sands; 15% gravel; 5% small cobbles.
GLACIAL OUTWASH

TP-8, Borrow Area A, ELEV. 709.[illegible] 11/2/64

0.0 - 1.6 SM — Sand, silty w/gravel, cobbles and boulders; yellow-brown color, poorly graded, dry, moderately permeable, loose. 20% fines; 40% sands; 10% gravels; 5% cobbles; 5% boulders (maximum size: 3.5 x 2.[illegible] x 2.0').

1.6 - [illegible].0 SC-SM — Sand, clayey w/gravel, cobbles and boulders; mottled, yellow-gray-brown and gray-brown color; poorly graded, very dense, platy structure; slowly permeable. 25% fines; 30% sands; 10% gravels; 5% small cobbles; 5% large cobbles; 5% boulders (maximum size: 1.6 x 1.[illegible] x 1.1).
GLACIAL TILL

TP-9, Borrow Area A, ELEV. 703.2 10/30/64

0.0 - [illegible].5 Topsoil

0.5 - 2.5 SM - Sand, silty w/gravel, cobbles and boulders; light yellow-brown color, poorly graded, firm, dry, moderately permeable. 30% fines; 40% sands; 10% gravels; 5% small cobbles; 15% large cobbles; 5% boulders.

2.5 - [illegible] SC-SP -- Sand, clayey w/gravel and cobbles; mottled, yellow-gray brown and gray-brown color, poorly graded, very dense, moist, slowly permeable. 10% fines; 40% sands; 10% gravels; 5% cobbles.
(SC)*
GLACIAL TILL

TP-10, 150' SE of TP-9, ELEV. 701.8 10/30/64

0.0 - 0.6 Topsoil

0.6 - 3.5 SM - Sand, silty w/gravel, cobbles and boulders; yellow-brown color; poorly graded, loose, moist, moderately permeable. 25% fines; 30% sands; 15% gravels; 25% cobbles; 5% boulders (maximum size: 3.0 x 2.5 x 2.0).

3.5 - [illegible].5 SC-SM — Sand, clayey w/gravel and cobbles; mottled blue-gray and yellow-brown color; poorly graded, very dense, moist, slowly permeable; platy structure. 45% fines; 40% sands; 10% gravels; 5% cobbles.
GLACIAL TILL

TP4.1, Borrow Area D, ELEV. 695.7 11/2/64

0.0 - 0.5 Topsoil

0.5 - 7.5 GM — Cobbles, gravelly w/silt, sand and boulders; yellow-brown w/very dark reddish brown staining, ship graded, dense, slightly cemented w/iron and/or manganese, moist, moderately permeable. 15% fines; 25% sands; 20% gravels; 15% small cobbles; 15% large cobbles; 10% boulders (maximum size: 2.0 x 2.[illegible] x 1.5).

7.5 - 9.0 SM — Sand, gravelly w/silt and cobbles; olive color, poorly graded, firm, wet, rapidly permeable. 15% fines; 40% fine sand; 25% medium and coarse sand; 10% gravels; 10% small cobbles.
GLACIAL OUTWASH

TP-12, Cen. Dike, STAT. 5+50, 120' NE, ELEV. 698.2 10/30/64

0.0 - 1.0 SM — Sand, silty w/gravel and cobbles; yellow-gray-brown to yellow-brown color; poorly graded, loose, moist, moderately permeable. 40% fines; 45% sands; 10% gravels; 5% cobbles.

1.0 - 7.5 SC-SM — Sand, clayey w/gravel and cobbles; mottled blue-gray and yellow-brown color; poorly graded, very dense, moist, slowly permeable, platy structure. 45% fines; 40% sands; 10% gravels; 5% cobbles.
GLACIAL TILL

TP-13, Borrow Area D, ELEV. 698.0 11/2/64

0.0 - 0.5 Topsoil

0.5 - 4.0 GM — Gravel, silty w/sand and cobbles; yellow-brown color; loose, moist, rapidly permeable. 15% fines; 35% sands; 45% small cobbles.

4.[illegible] - 6.0 GP — Gravel, silty w/sand and cobbles; light yellow-brown color, firm, subrounded, moist, rapidly permeable; 15% fines; 30% sands; 10% small cobbles; 5% large cobbles.

6.0 - 7.0 GM — Gravel, sandy w/silt and cobbles; yellow-brown color, moist, rapidly permeable. 15% fines; 35% sand, 45% gravels; cobbles.
GLACIAL OUTWASH

7.0 - 13.[illegible] SC-SM — Sand, clayey w/gravel, cobbles and boulders; olive color, graded, very dense, wet, slowly permeable. 45% fines; 25% sands; 5% small cobbles, 5% large cobbles, 5% boulders (maximum size: 1.2).
GLACIAL TILL

TP-14, 30' East of South Dike, ELEV. 698.8 11/6/64

0.0 - 4.5 SM — Sand, silty w/ gravel, cobbles, and boulders; yellow-brown color, poorly graded, dense, moist to 4.0, wet below 4.0, slowly permeable; 35% fines; 35% sands; 25% gravels; 10% small cobbles; 5% large boulders (maximum size: 2.5 x 2. x 1.[illegible]).

4.5 - 1.[illegible] CL — Clay, sandy w/ gravel; olive color; stiff, moist, slowly fines; 10% sands; 10% gravels.
GLACIAL OUTWASH

TP-15, 30' East of South Dike, ELEV. 696.[illegible] 11/6/64

0.0 - [illegible] SM — Sand, silty w/ gravel, cobbles, and boulders; yellow-brown graded, dense, moist to 6.0, wet below 6.0, moderately permeable; 30% sands; 30% gravels; 10% small cobbles; 5% large cobbles (maximum size: 2. x 2. x 1.[illegible]).
GLACIAL OUTWASH

TP-16, 30' South of South Dike, ELEV. 69[illegible] [illegible]/6/64

0.[illegible] - [illegible].[illegible] SM — Sand, silty w/clay, gravel, and cobbles; yellow-brown graded, very dense, platy structure, moist, slowly permeable; 30% sands; 10% gravels; 5% small cobbles; 5% large cobbles.
GLACIAL TILL

TP-104, STAT. B+50, 3+75; ELEV. 690.4 11/6/64

0.0 - 4.4 GP-GM — Gravel, sandy w/silt, cobbles, and boulders; yellow-graded, firm, moist; 10% fines; 25% sands; 30% gravels; 5% 7% large cobbles; 20% boulders (maximum size: 6.0 x 4.5 x 2.

4.4 - 7.9 (CL-ML)* CL — Clay, silty w/sands; olive color; stiff, moist, slowly fines; 25% sands.

7.9 - 10.4 CL — Clay, silty w/sand; blue-gray color; stiff, moist, slow 90% fines; 10% sands.

10.4 - 15.[illegible] SP-SM — Sand, silty w/ gravel and cobbles; dark yellow-brown graded, dense, wet, moderately permeable. 10% fines; 50% sand 5% small cobbles.
GLACIAL OUTWASH

TP-105, Borrow Area B, ELEV. 701.1 10/30/64

0.0 - 0.5 Topsoil

0.5 - 6.0 GP-GM — Gravel, silty w/sand and cobbles; loose, dry to 4.5, bedded, rapidly permeable. 10% fines; 15% sands; 40% gravels; cobbles; 10% large cobbles; 5% boulders (maximum size: 1. x
GLACIAL OUTWASH

6.0 - [illegible].5 GP — Gravel, silty w/sands, cobbles and boulders; olive color, loose, moist, rapidly permeable. 15% fines; 30% sands; 25% small cobbles; 10% large cobbles; 5% boulders (maximum size:
GLACIAL OUTWASH

9.5 - 12.0 (SC-SM)* SM — Sand, silty w/gravels and cobbles; olive color; poorly dense, moist, slowly permeable. 35% fines; 40% sands; 15% small cobbles; 5% large cobbles.
GLACIAL TILL

TP4.06, 20' SE of TP-105, ELEV. 691.4 10/30/64

0.0 - 0.5 Topsoil

0.5 - 8.0 (GM)* GM — Gravel, silty with sands, cobbles, and boulders; yellow-skip graded, firm, dry to 1.0, moist to 5.8, wet to 8.0, rapidly 15% fines; 35% sands; 25% gravels; 10% small cobbles; 10% 5% boulders (maximum size: 1.[illegible] x 1.0 x 0.[illegible]).
GLACIAL OUTWASH

2

rrow Area B, ELEV. 698.0 11/3/64

Topsoil

GM -- Gravel, silty w/sand and cobbles; yellow-brown color; skip graded, loose, moist, rapidly permeable. 15% fines; 35% sands; 45% gravels; 5% small cobbles.

GP -- Gravel, silty w/sand and cobbles; light yellow-brown color; ski; graded, firm, subrounded, moist, rapidly permeable; 15% fines; 30% sands; 40% gravels; 10% small cobbles; 5% large cobbles.

GP -- Gravel, sandy w/silt and cobbles; yellow-brown color; ski; graded, moist, rapidly permeable. 15 fines; 35% sands; 45% gravels; 5% small cobbles.
GLACIAL OUTWASH

SC-SM -- Sand, clayey w/gravel, cobbles and boulders; olive color; poorly graded, very dense, wet, slowly permeable. 45% fines; 25% sands; 15% gravels; 5% small cobbles; 5% large cobbles; 5% boulders (maximum size: 1.6 x 2.0 x 1.2).
GLACIAL TILL

South of South Dike, ELEV. 698.8 11/3/64

SM -- Sand, silty w/ gravel, cobbles, and boulders; yellow-brown color; poorly graded, dense, moist to 4.0, wet below 4.0, moderately permeable. 15% fines; 30% sands; 25% gravels; 10% small cobbles; 10% large cobbles; 10% boulders (maximum size: 2.5 x 2.0 x 1.0).

CL -- Clay, sandy w/ gravel; olive color; stiff, moist, slowly permeable. 90% fines; 10% sands; 10% gravels.
GLACIAL TILL

South of South Dike, ELEV. 694.2 11/3/64

SM -- Sand, silty w/ gravel, cobbles, and boulders; yellow-brown color; poorly graded, dense, moist to 6.0, wet below 6.0, moderately permeable. 20% fines; 30% sands; 20% gravels; 10% small cobbles; 10% large cobbles; 10% boulders (maximum size: 2.5 x 2.0 x 1.0).
GLACIAL OUTWASH

South of South Dike, ELEV. 691.2 11/4/64

SM -- Sand, silty w/clay, gravel, and cobbles; yellow-brown color; poorly graded, very dense, moist, slowly permeable; 25% fines; 50% sands; 10% gravels; 5% small cobbles; 5% large cobbles.
GLACIAL TILL

B-C0, 3+75; ELEV. 690.4 11/4/64

GP-GM -- Gravel, sandy w/silt, cobbles, and boulders; yellow-brown color, ski; graded, firm, moist; 10% fines; 25% sands; 30% gravels; 5% small cobbles; 7% large cobbles; 20% boulders (maximum size: 6.0 x 4.5 x 2.0).

CL -- Clay, silty w/sands; olive color; stiff, moist, slowly permeable. 75% fines; 25% sands.

CL -- Clay, silty w/sand; blue-gray color; stiff, moist, slowly permeable. 90% fines; 10% sands.

SM-SP -- Sand, silty w/ gravel and cobbles; dark yellow-brown color; poorly graded, dense, wet, moderately permeable. 10% fines; 50% sands; 35% gravels; 5% small cobbles.
GLACIAL OUTWASH

rrow Area B, ELEV. 701.1 10/30/64

Topsoil

GP-GM -- Gravel, silty w/sand and cobbles; loose, dry to 4.5, moist 4.5 to 6.0, bedded, rapidly permeable. 10% fines; 30% sands; 40% gravels; 15% small cobbles; 10% large cobbles; 5% boulders (maximum size: 1.5 x 1.0 x 1.5).
GLACIAL OUTWASH

GP -- Gravel, silty w/sands, cobbles and boulders; olive color; poorly graded, loose, moist, rapidly permeable. 15% fines; 30% sands; 25% gravels; 15% small cobbles; 10% large cobbles; 5% boulders (maximum size: 2.5 x 1.5 x 1.0).
GLACIAL OUTWASH

SM -- Sand, silty w/gravels and cobbles; olive color; poorly graded, very dense, moist, slowly permeable. 35% fines; 40% sands; 15% gravels; 5% small cobbles; 5% large cobbles.
GLACIAL TILL

SE of TP-105, ELEV. 697.4 10/30/64

Topsoil

SM -- Gravel, silty with sands, cobbles, and boulders; yellow-brown color; skip graded, firm, dry to 3.6, moist to 5.8, wet to 8.0, rapidly permeable. 15% fines; 35% sands; 25% gravels; 10% small cobbles; 10% large cobbles; 5% boulders (maximum size: 1.5 x 1.0 x 0.5).
GLACIAL OUTWASH

TP-107, 688, Dike STAT. 7+90, 875'E, ELEV. 700.0 10/29/64

0.0 - 0.8 Topsoil

0.8 - 1.8 SM — Sand, silty w/gravel, cobbles and boulders; yellow and red-brown color; poorly graded; loose, moist, moderately permeable; 30% fines; 40% sands; 10% gravels; 5% small cobbles; 5% large cobbles; 10% boulders (maximum size: 2.5 x 2.0 x 1.0).

1.8 - 4.6 SM — Sand, silty w/gravel, cobbles and boulders; light yellow-gray-brown color; mottled, poorly graded, dense, moist, slowly permeable, platy structure. 40% fines; 55% sands; 10% gravels; 5% small cobbles; 5% large cobbles; 5% boulders (average size: 1.5 x 1.5 x 1.0).

4.6 - 7.0 SM — Sand, silty w/gravel, cobbles, and boulders; yellow-brown color; poorly graded, very dense, moist, slowly permeable, platy structure. 25% fines; 50% sands; 10% gravels; 5% small cobbles; 5% large cobbles; 5% boulders.

7.0 - 12.8 SM — Sand, silty w/gravel, cobbles and boulders; mottled blue-grey and yellow-gray-brown color; poorly graded, very dense, moist, slowly permeable, platy structure. 40% fines; 30% sands; 15% gravels; 10% cobbles; 5% boulders (maximum size: 1.1 x 1.2 x 1.0).
GLACIAL TILL

TP-108, CBR. Dike STAT. 8+50, 200'E, ELEV. 700.4 10/29/64

0.0 - 1.8 SM — Sand, silty w/gravel, cobbles and boulders; yellow and red-brown color; poorly graded, loose, moist, moderately permeable. 30% fines; 40% sands; 10% gravels; 5% small cobbles; 5% large cobbles; 10% boulders (maximum size: 2.5 x 2.0 x 1.0).

1.8 - 4.5 SM — Sand, silty w/gravel, cobbles and boulders; mottled, light yellow-gray-brown color; poorly graded, dense, moist, slowly permeable, platy structure. 20% fines; 55% sands; 10% gravels; 5% small cobbles; 5% large cobbles; 5% boulders (average size: 1.5 x 1.5 x 1.0).

4.5 - 8.9 SM — Sand, silty w/gravel, cobbles and boulders; yellow-brown color; poorly graded, very dense, moist, slowly permeable, platy structure. 25% fines; 50% sands; 10% gravels; 5% small cobbles; 5% large cobbles; 5% boulders.

8.9 - 13.5 SM — Sand, silty w/gravel, cobbles and boulders; mottled, blue grey and yellow-gray-brown color; poorly graded, very dense, moist, slowly permeable, platy structure. 40% fines; 30% sands; 15% gravels; 10% cobbles; 5% boulders (maximum size: 1.1 x 1.5 x 1.0).
GLACIAL TILL

TP-109, Borrow Area A, ELEV. 703.5 11/5/64

0.0 - 2.0 SM — Sand, silty w/gravel, cobbles and boulders; light yellow-brown color; poorly graded, firm, dry, moderately permeable. 30% fines; 50% sands; 10% gravels; 5% small cobbles; 5% boulders (maximum size: 1.0 x 1.0 x 1.5).

2.0 - 8.0 SC-SM — Sand, clayey w/gravel and cobbles; mottled yellow-grey-brown and grey-brown color; poorly graded, very dense, moist, slowly permeable. 50% fines; 35% sands; 10% gravels; 5% small cobbles.
GLACIAL TILL

TP-110, 700' South of South Dike, ELEV. 727.0 11/6/64

0.0 - 13.0 (SM)* SM — Sand, silty w/clay, gravel and cobbles; yellow-brown color; poorly graded, very dense, platy structure, moist, slowly permeable. 25% fines; 50% sands; 15% gravels; 5% small cobbles; 5% large cobbles.
GLACIAL TILL

TP-111, STAT. B+05, 10+95; ELEV. 698.0 11/5/64

0.0 - 6.0 SM — Sand, silty w/gravel, cobbles, and boulders; light yellow-brown color; skip graded, dense, moist, moderately permeable, 15% fines; 35% sands; 20% gravels; 8% small cobbles; 7% large cobbles; 15% boulders (maximum size: 6.5 x 4.0 x 2.0).
GLACIAL TILL

TP-201, STAT. B+80, 2+95; ELEV. 700.2 11/3/64

0.0 - 0.5 Topsoil

0.5 - 3.5 (SM)* SM — Sand, silty w/gravel, cobbles and boulders; yellow-brown color; poorly graded, firm, moist, moderately permeable. 20% fines; 30% sands; 10% gravels; 10% small cobbles; 10% large cobbles; 10% boulders (maximum size: 6.0 x 6.0 x 3.0).

3.5 - 5.3 SP — Sand w/gravel, cobbles and boulders; light yellow-gray-brown color; poorly graded, dense, moist, rapidly permeable. 75% sands; 10% gravels; 5% small cobbles; 5% large cobbles; 5% boulders (maximum size: 1.5 x 1.0 x 1.0).
GLACIAL OUTWASH

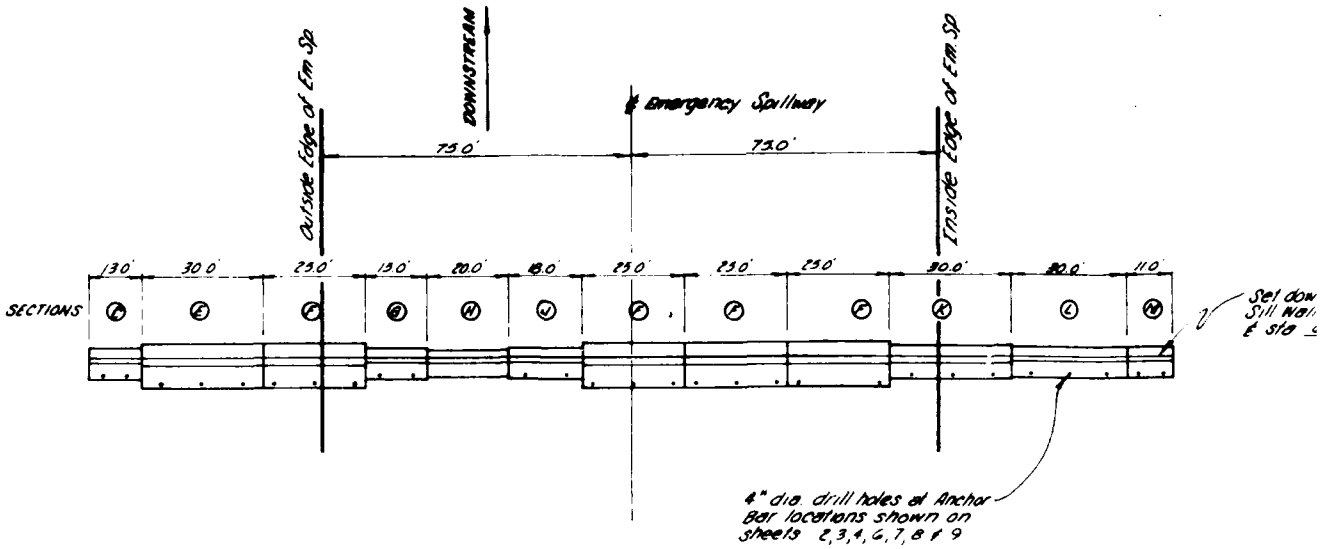
5.3 - Bedrock
Argillite and diorite, fractured, very hard.

* UNIFIED SOIL CLASSIFICATION BY LABORATORY

SUSQUEHANNA RIVER BASIN COMPREHENSIVE PROJECT
TUNKHANNOCK WATERSHED AREA NO. 8
LUZERNE, WYOMING COUNTY, AND NORTHWESTERN
STATE OF NEW YORK

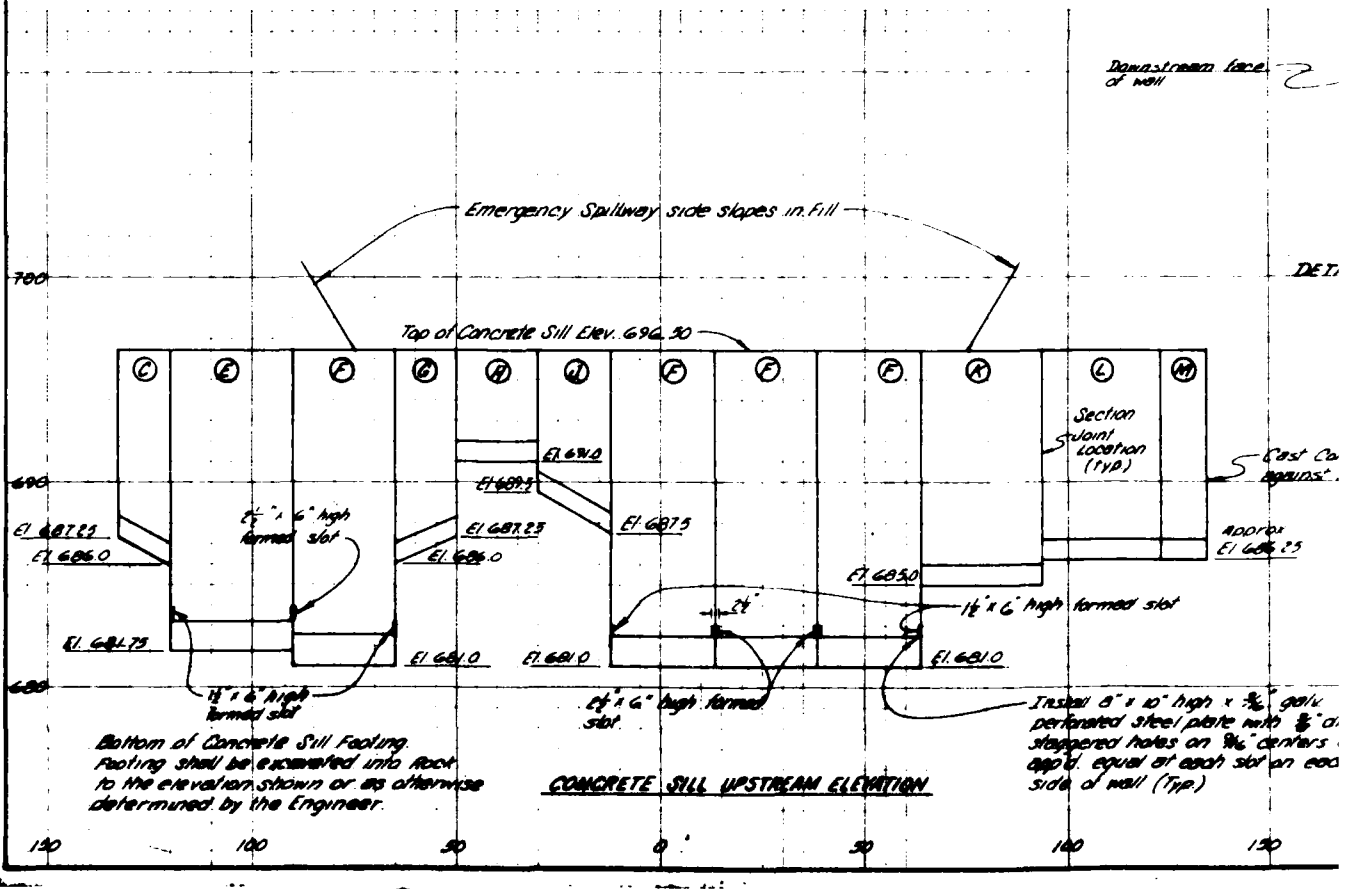
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Recommended by: ... Date ...
Approved by ...
Date ...
Drawn ...
Date ...
Traced by ...
Date ...
Photographed by ...
Date ...
Checked by ...

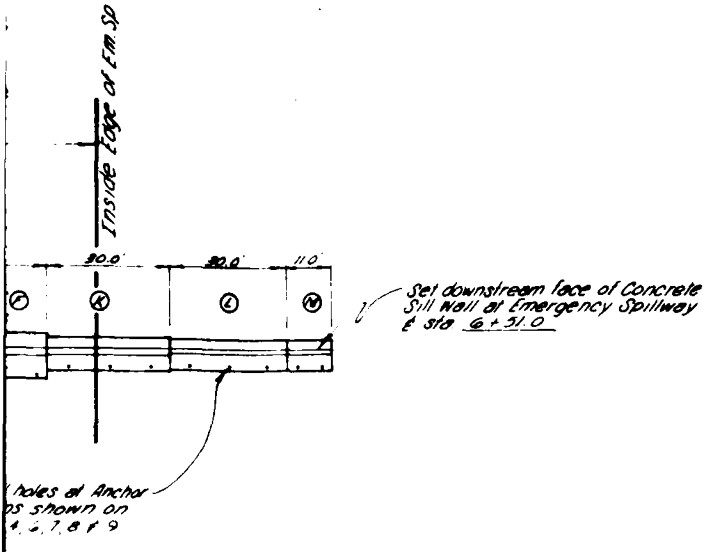


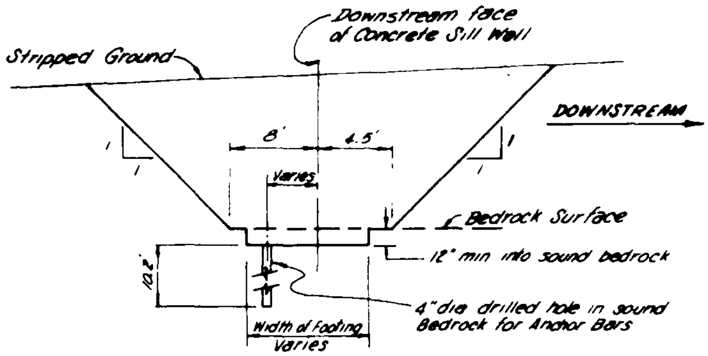
PLAN VIEW OF CONCRETE SILL

0 20 40 60 FT



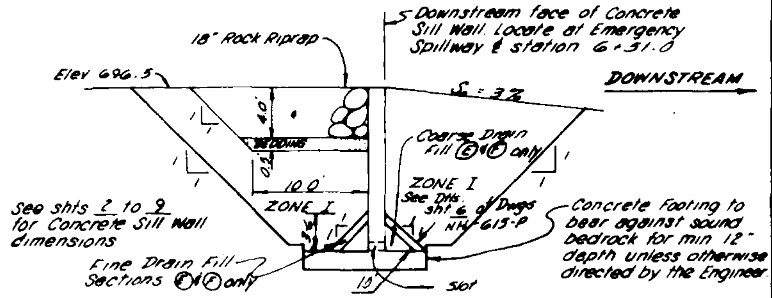
CONCRETE SILL UPSTREAM ELEVATION





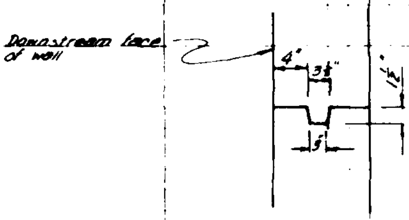
TYPICAL EXCAVATION SECTION OF CONCRETE SILL

NO SCALE



TYPICAL FILL PLACEMENT AT CONCRETE SILL

NO SCALE

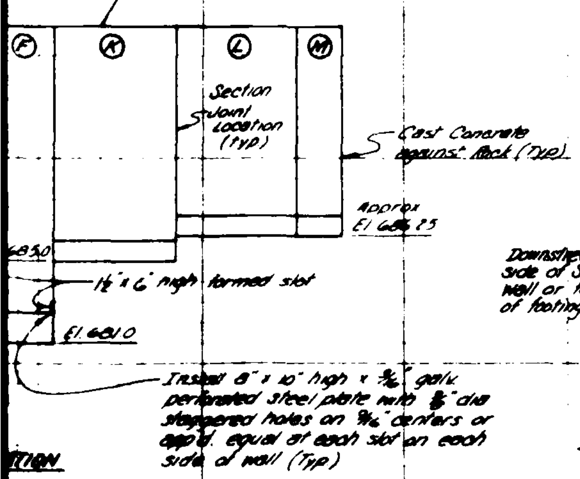


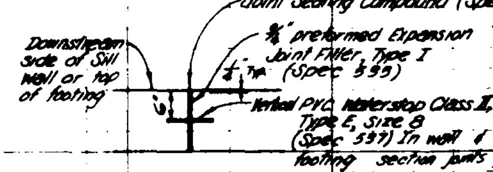
DETAIL OF HORIZONTAL CONSTRUCTION JOINTS IN WALLS

NO SCALE

CONSTRUCTION DETAILS

1. Section M. Details may vary depending on the actual Sound Bedrock Line. Depth of actual Rock Excavation, Footing elevations, and dimensions will be determined by the Engineer after sound Rock Elevation is confirmed.
2. Rock Riprap and Bedding shall be as specified on sht. 12 of NH-615-P
3. Drain Fill shall be as specified for the Embankment Drain Trench.
4. All Reinforcing Steel placed in concrete cast against unformed surfaces shall have 3 inches clear cover unless shown otherwise. Reinforcing Steel shall have 2 inches clear cover from formed and exposed unformed surfaces unless shown otherwise.
5. Horizontal Construction Joints above the first joint in walls may be eliminated if approved by the Engineer.
6. See sheets 2-9 for location of Construction Joints.





PLAN OF WATERSTOP DETAIL AT WALL AND FOOTING SECTION JOINTS

NO SCALE

SOUHEGAN RIVER WATERSHED PROJECT
FLOODWATER RETARDING DAM NO. 8
LYNDEBOROUGH, HILLSBOROUGH CO., N.H.

EMERGENCY SPILLWAY SILL DETAILS

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed R. Henninger / L. Beck	Date 2/77	Approved [signature]	State Conservation Engineer
Drawn D.M.	2/77	Title	
Traced			
Checked Len Beck	4/77	Sheet No. 1 of 10	Drawing No. NH-615-A

MAINTENANCE CHECKLIST FOR PL 566 FLOOD CONTROL STRUCTURES

This maintenance checklist is a guide for determining the maintenance required for Public Law 566 flood control structures in New Hampshire. It doesn't take the place of experience and judgment and is not inclusive. Items of a difficult nature to check, such as principal spillway conduit condition, are not included. Intensive checks of these items are necessary at proper intervals. Review of As Built drawings, the design folder, structure history, and previous maintenance reports should be part of the inspection. Prompt maintenance is a vital part of safe and effective operation.

Except where otherwise indicated, completion of this form may be facilitated by ranking maintenance items on a 1 to 4 basis where

1 = satisfactory
2 = satisfactory, but check carefully at next inspection
3 = requires maintenance this season
4 = requires immediate attention.

147.28

Cem. Dam

WATERSHED Saco River SITE 8 & Dam DATE 6-15-78

INSPECTED BY Porter, Hutchinson, MacPherson, Kerr

1. GENERAL ITEMS

Access Road.	2
Site Fencing.	1
Traffic Conditions.	1
Vandalism Control.	1
Trash Control.	4

COMMENTS Remove trash from L.S. trash rack.

2. RESERVOIR

Timber stand at reservoir.	2
Debris and slash.	2
Sediment level in relation to low stage inlet	2

COMMENTS

SOIL CONSERVATION SERVICE
US DEPARTMENT OF AGRICULTURE

3. EMBANKMENT AND EXCAVATED SLOPES

(Report riprap and vegetation and erosion condition under Items 4 and 5.)

	Dam	Cem. Dike	Emergency Spillways left	Emergency Spillways right 1/	Other (____)	Other (____)
Sliding or sloughing	1	1	1	___	___	___
Holes (rodent and other) (check especially at embankments)	1	1	1	___	___	___
Excessive settlement (embankments)	1	1	1	___	___	___
Cracks						
Traverse	1	1	1	___	___	___
Longitudinal	1	1	1	___	___	___
Seepage 2/	1	1	1	___	___	___
Piping 2/	1	1	1	___	___	___

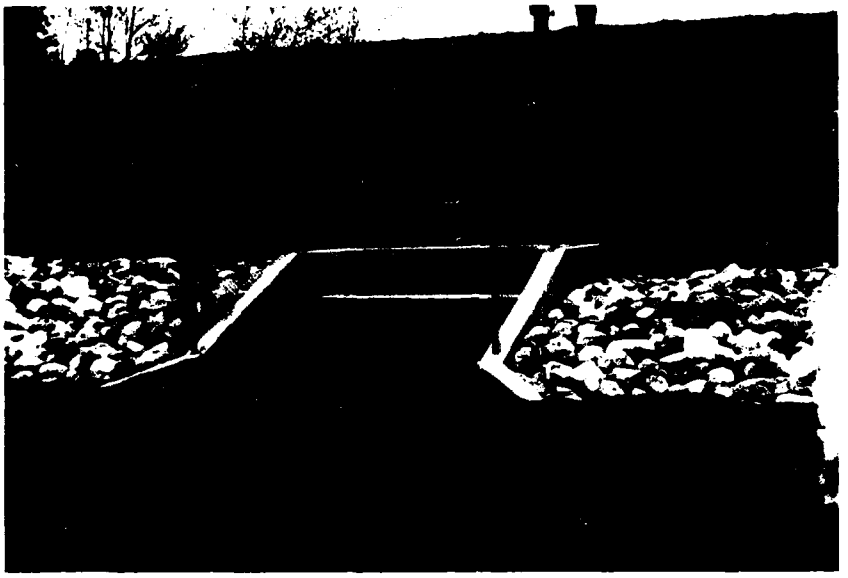
COMMENTS _____

4. RIPRAP

	Displ. of Rock	Loss of Spalls	Loss of Bedding	Erosion of Found.	Break-down of Rock
Dam					
Upstream berm	1	1	1	1	1
Principal Spillway Outlet	___	___	___	___	___
Embankment Gutters					
left	___	___	___	___	___
right	___	___	___	___	___
Emergency Spillway					
location sill	1	1	1	1	1
location level lip spreaders	1	1	1	1	1
Waterways					
location _____	___	___	___	___	___
location _____	___	___	___	___	___
Outlet Channel	1	1	1	1	1
Other Transfer channels	2	1	1	1	1

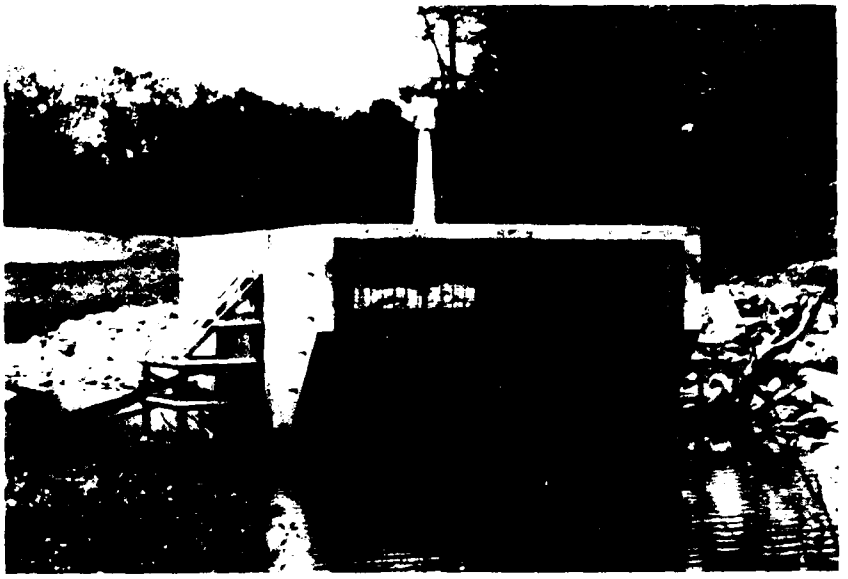
COMMENTS _____

1/Looking downstream.
2/Check especially at downstream face of embankments. [illegible] erosion.



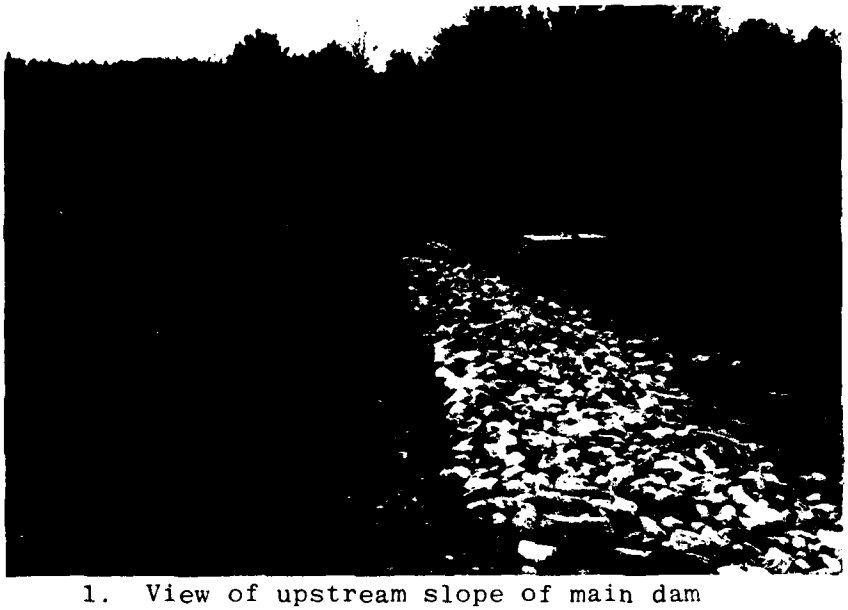
5. View of impact basin showing minor erosion of embankment

6. Close up view of embankment erosion

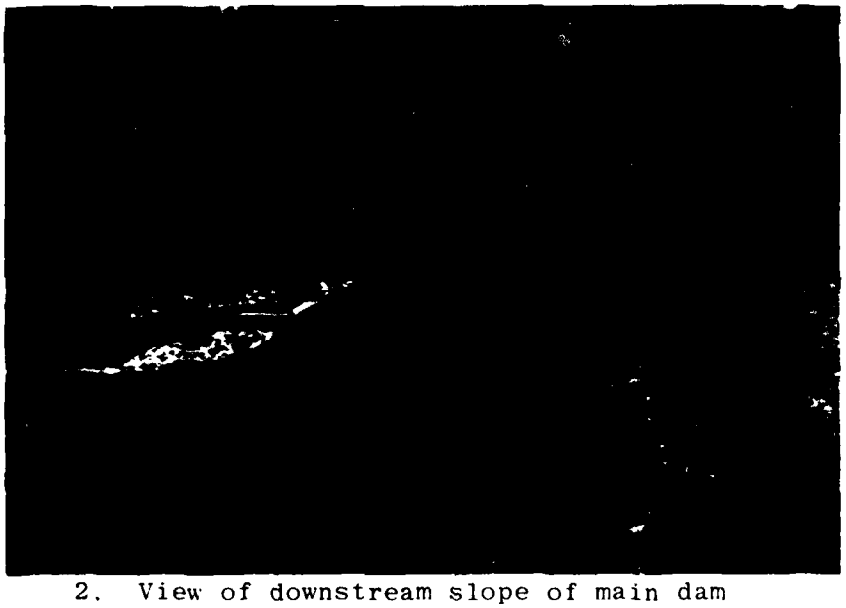


3. View of drop inlet structure showing high and low stage trash racks

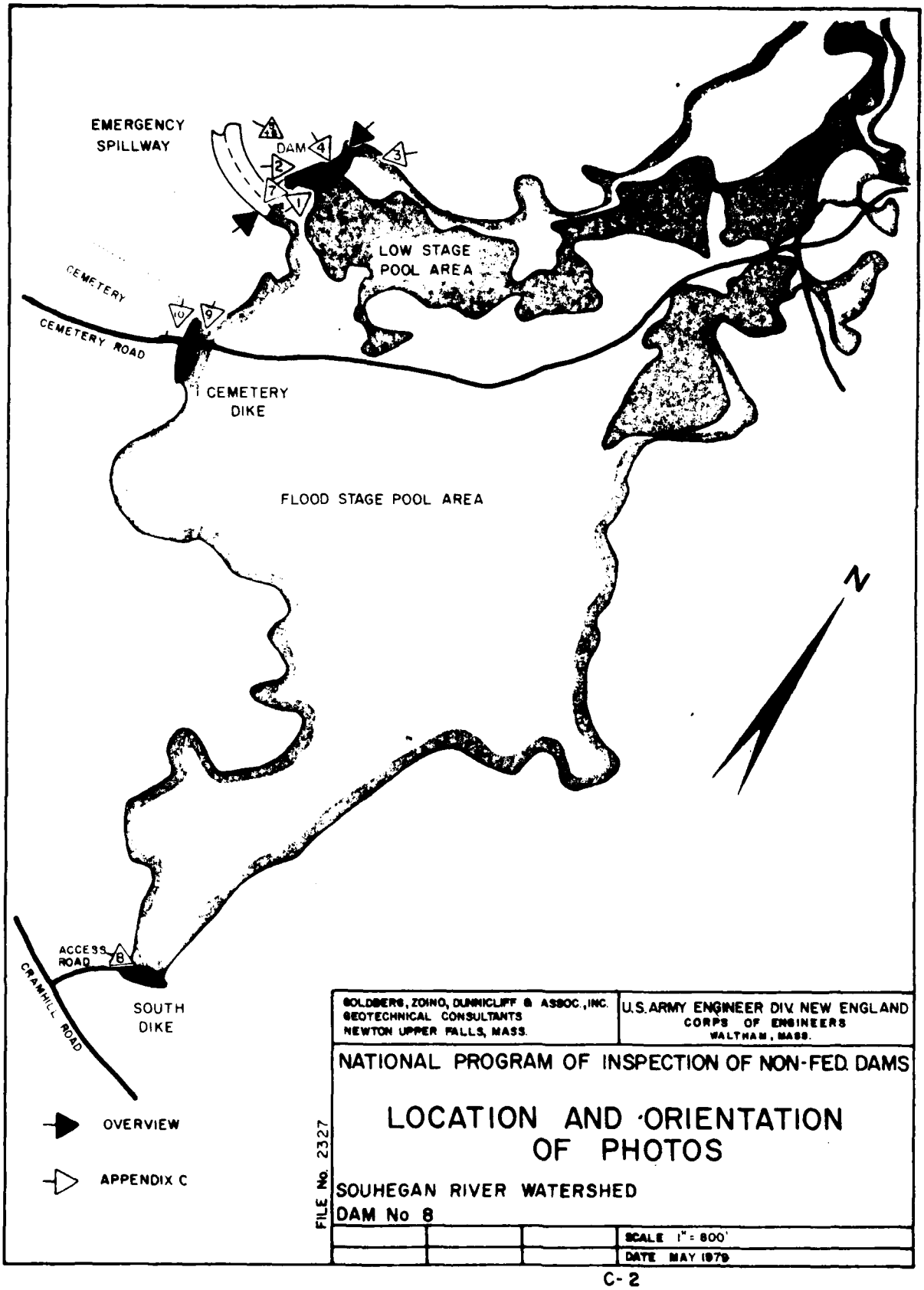
4. View of downstream end of outlet pipe showing washed out joint filler



1. View of upstream slope of main dam from left side



2. View of downstream slope of main dam from left side



GOLDBERG, ZOINO, DUNNICLIFF & ASSOC., INC.
GEOTECHNICAL CONSULTANTS
NEWTON UPPER FALLS, MASS.

U.S. ARMY ENGINEER DIV. NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

LOCATION AND ORIENTATION OF PHOTOS

SOUHEGAN RIVER WATERSHED
DAM No 8

FILE No. 2327

SCALE 1" = 800'
DATE MAY 1979

APPENDIX C

PHOTOGRAPHS

The U.S.D.A. Soil Conservation Service (SCS) located in Durham, New Hampshire, maintains a file for this dam. Included in this file are:

1) SCS "Design Report" dated May 1965.

2) SCS "Design Report Summary" dated May 1976.

3) SCS "Design Comments" dated June 1972.

4) SCS Hydrology design calculations dated 1974.

5) SCS structural design calculations dated 1976.

6) SCS "Detailed Geological Investigation of Dam Sites" dated 1965.

7) SCS soil mechanics laboratory data sheets dated 1967.

8) SCS "As Built" drawings dated 1977.

The New Hampshire Water Resources Board (NHWRB) maintains a correspondence file on this dam. Included in this file are:

1) Maintenance inspection checklists dated June 15, 1978.

MPACT BASIN, SAF, BOX INLET, & MISCELLANEOUS CONCRETE STRUCTURES

(specify)_____ _____

Concrete: inside and out	Cracking___; Spalling___; Other deterioration ___; Excessive movement (check joints)___; Waterstops___; Joint scalant___; Other___.
Trashracks: low and high stage	Condition of protective coatings___; Corrosion ___; Damaged parts___; Condition of fastenings___; Need of gratings due to beaver___; Safety condition (protruding fastenings, sharp edges, etc.)___; Other___.
Gates: including lifting device, stem, guides, disc, flap	Condition of protective coating___; Corrosion ___; Damaged parts___; Condition of fastenings___; Stem alignment___; Operation___; Lubrication___; Wood decay___; Other___.
Structure Drainage:	Report under "Embankment and Other Drains"
Structure, Railing, Grates, Barriers, etc.	Condition of protective coating___; Corrosion ___; Damaged parts___; Condition of Fastenings___; Wood decay___; Safety condition (protruding fastenings, sharp edges, etc.) ___; Other___.
Safety Items:	Condition of warning signs___; Condition of safety equipment___; Other___.

COMMENTS Not applicable.

9. CHANNEL

Stream obstructions. . . . . ___
Debris in stream. . . . . ___
Sediment bars controlled. . . . . ___
Plunge pool stability. . . . . ___
Fish habitat appurtenances . . . . . ___
Riprap -- Report under "Riprap" (item 4) ___ ___

COMMENTS Not applicable.

RISER

	Caution Be extremely careful when using ladders. Check condition before using. Ladders are sometimes broken, loose, corroded, and or slippery. Use safety harness.
Ladders: inside and out	Condition of protective coating___; Corrosion___; Damaged parts___; Loose___; Other___.
Concrete: inside and out	Cracking___; Spalling___; Other deterioration ___; Excessive movement (check joint at riser and conduit)___; Other___.
Trashracks: low and high stage	Condition of protective coatings___; Corrosion ___; Damaged parts___; Condition of fastenings ___; Need of gratings due to beaver___; Safety condition (protruding fastenings, sharp edges, etc.)___; Other___.
Manhole:	Condition of protective coatings___; Corrosion ___; Damage___; Lock operable___; Other___.
Gate: including lifting device, stem, guides, disc	Condition of protective coating___; Corrosion ___; Damaged parts___; Condition of fastenings___; Stem alignment___; Lubrication___; Operation___; Other___.
Safety Items:	Condition of warning signs___; Condition of safety equipment___; Other___.

COMMENTS Not applicable.

VEGETATION

	Dam	Emergency Spillways left	Emergency Spillways right 1/	Dike	Outlet Channel	Water way	Other (_____)
Condition of stand (including need for lime and fertilizer)	—	—	—	4	—	—	—
Undesirable vegetation	—	—	—	1	—	—	—
Drainage (surface)	—	—	—	4	—	—	—
Erosion 2/	—	—	—	1	—	—	—
Sedimentation	—	—	—	1	—	—	—
Condition of planting	—	—	—	4	—	—	—
Pest control	—	—	—	1	—	—	—
Fire control	—	—	—	1	—	—	—

COMMENTS The legumes should be aerial seeded as a frost seeding next spring. (1979)

Remove down pine tree in borrow area. Fill low area beyond upstream side of dike.

6. EMBANKMENT: STRUCTURAL, & OTHER DRAINS

		Dam left	Dam right 1/	S.Other (pipe)	S.Other (_____)
Depth of Flow (in inches above invert)	With any obstruction	—	—	NA	—
	Without any obstruction	—	—	NA	—
Turbidity of Discharge (yes, no)	With any obstruction	—	—	NA	—
	Without any obstruction	—	—	NA	—
Condition of Protective Coating	Outside	—	—	NA	—
	Inside	—	—	NA	—
Obstruction in Flow (yes, no)		—	—	NA	—
Animal Guard Condition		—	—	NA	—
Outlet Condition		—	—	3	—

Retarding Pool Elevation (ft. msl)_____ or_____(ft.) above / below _____

Other_____

COMMENTS Low area below downstream toe of dike should be filled to eliminate ponding. This should be done prior to revegetation.

1/Looking downstream.
2/Including wave, surface, stream, manmade, and livestock erosion.

EMBANKMENT AND EXCAVATED SLOPES

(Report riprap and vegetation and erosion condition under Items 4 and 5.)

	Dam	Dike	Emergency Spillways left	Emergency Spillways right 1/	Other (____)	Other (____)
Sliding or sloughing	___	1	___	___	___	___
Holes (rodent and other) (check especially at embankments)	___	1	___	___	___	___
Excessive settlement (embankments)	___	1	___	___	___	___
Cracks						
Traverse	___	1	___	___	___	___
Longitudinal	___	1	___	___	___	___
Seepage 2/	___	1	___	___	___	___
Piping 2/	___	1	___	___	___	___

COMMENTS _____

4. RIPRAP

	Displ. of Rock	Loss of Spalls	Loss of Bedding	Erosion of Found.	Breakdown of Rock
Dam					
Upstream berm	___	___	___	___	___
Principal Spillway Outlet	___	___	___	___	___
Embankment Gutters					
left	___	___	___	___	___
right	___	___	___	___	___
Emergency Spillway					
location_____	___	___	___	___	___
location_____	___	___	___	___	___
Waterways					
location_____	___	___	___	___	___
location_____	___	___	___	___	___
Outlet Channel	___	___	___	___	___
Other_____	___	___	___	___	___

COMMENTS Not applicable

1/Looking downstream.
2/Check especially at downstream face of embankments

MAINTENANCE CHECKLIST FOR PL 566 FLOOD CONTROL STRUCTURES

This maintenance checklist is a guide for determining the maintenance required for Public Law 566 flood control structures in New Hampshire. It doesn't take the place of experience and judgment and is not inclusive. Items of a difficult nature to check, such as principal spillway conduit condition, are not included. Intensive checks of these items are necessary at proper intervals. Review of As Built drawings, the design folder, structure history, and previous maintenance reports should be part of the inspection. Prompt maintenance is a vital part of safe and effective operation.

Except where otherwise indicated, completion of this form may be facilitated by ranking maintenance items on a 1 to 4 basis where

1 = satisfactory
2 = satisfactory, but check carefully at next inspection
3 = requires maintenance this season
4 = requires immediate attention.

147.28

WATERSHED Souhegan River SITE 8-S. Dike DATE 6-15-78

INSPECTED BY Porter, Hutchinson, MacPherson, Kerr, Fife

1. GENERAL ITEMS

Access Road.	1
Site Fencing.	1
Traffic Conditions.	1
Vandalism Control.	1
Trash Control.	1

COMMENTS

2. RESERVOIR

Timber stand at reservoir.	1
Debris and slash.	1
Sediment level in relation to low stage inlet	1

COMMENTS

SOIL CONSERVATION SERVICE
U.S. DEPARTMENT OF AGRICULTURE

(specify) Impact Basin E. S. Sill

Concrete: inside and out	Cracking 1 ; Spalling 1 ; Other deterioration 1 ; Excessive movement (check joints) 1 ; Waterstops 1 ; Joint sealant 1 ; Other___.
Trashracks: low and high stage	Condition of protective coatings___; Corrosion ___; Damaged parts___; Condition of fastenings___; Need of gratings due to beaver___; Safety condition (protruding fastenings, sharp edges, etc.)___; Other___.
Gates: including lifting device, stem, guides, disc, flap	Condition of protective coating___; Corrosion ___; Damaged parts___; Condition of fastenings___; Stem alignment___; Operation___; Lubrication___; Wood decay___; Other___.
Structure Drainage:	Report under "Embankment and Other Drains"
Structure, Railing, Grates, Barriers, etc.	Condition of protective coating 1; Corrosion 1; Damaged parts 1; Condition of Fastenings___; Wood decay___; Safety condition (protruding fastenings, sharp edges, etc.) ___; Other___.
Safety Items:	Condition of warning signs___; Condition of safety equipment___; Other___.

COMMENTS

9. CHANNEL

Stream obstructions.	4
Debris in stream.	4
Sediment bars controlled.	2
Plunge pool stability.	1
Fish habitat appurtenances	NA
Riprap -- Report under "Riprap" (item 4)	

COMMENTS Obstruction downstream - at least 2 beaver dams.

-- downstream face of embankments.

7. RISER

Caution Be extremely careful when using ladders. Check condition before using. Ladders are sometimes broken, loose, corroded, and or slippery.
Use safety harness.

Ladders: inside and out	Condition of protective coating___; Corrosion___; Damaged parts___; Loose___; Other___.
Concrete: inside and out	Cracking 1; Spalling 1; Other deterioration 1; Excessive movement (check joint at riser and conduit)___; Other___.
Trashracks: low and high stage	Condition of protective coatings 1; Corrosion 1; Damaged parts 1; Condition of fastenings 1; Need of gratings due to beaver 2; Safety condition (protruding fastenings, sharp edges, etc.) 1; Other___.
Manhole:	Condition of protective coatings 1; Corrosion 1; Damage 1; Lock operable 1; Other___.
Gate: including lifting device, stem, guides, disc	Condition of protective coating 1; Corrosion 1; Damaged parts___; Condition of fastenings___; Stem alignment___; Lubrication___; Operation___; Other___.
Safety Items:	Condition of warning signs___; Condition of safety equipment___; Other___.

COMMENTS W.R.B. will check gate - no ladder.

[illegible] use of embankments.

5. VEGETATION

	Dam	Emergency Spillways left	Emergency Spillways right 1/	Cem. Dike	Outlet Channel	Water way	Other (_____)
Condition of stand (including need for lime and fertilizer)	2	2	—	2	—	—	—
Undesirable vegetation	1	1	—	1	—	—	—
Drainage (surface)	1	1	—	1	—	—	—
Erosion 2/	1	1	—	1	—	—	—
Sedimentation	1	1	—	1	—	—	—
Condition of planting	1	1	—	1	—	—	—
Pest control	1	1	—	1	—	—	—
Fire control	1	1	—	1	—	—	—

COMMENTS _____

6. EMBANKMENT, STRUCTURAL, & OTHER DRAINS

		Dam left	Dam right 1/	Cem. Dike	Other (____)
Depth of Flow (in inches above invert)	With any obstruction	4	4	1	—
	Without any obstruction	4	4	1	—
Turbidity of Discharge (yes, no)	With any obstruction	4	4	1	—
	Without any obstruction	4	4	1	—
Condition of Protective Coating	Outside	4	4	NA	—
	Inside	4	4	NA	—
Obstruction in Flow (yes, no)		4	4	NA	—
Animal Guard Condition		4	4	NA	—
Outlet Condition		4	4	NA	—

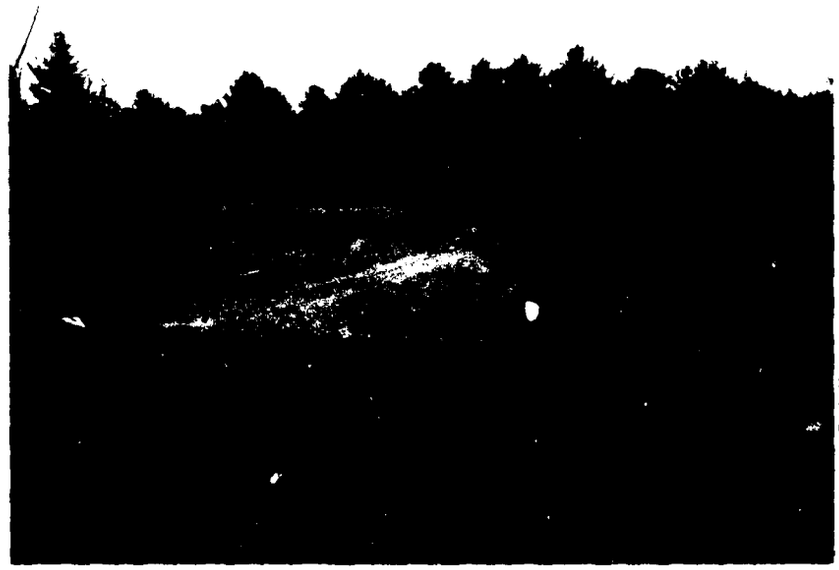
Retarding Pool Elevation (ft. msl)_____ or 1 (ft.) above top of ~~pipe~~ L.S. orifice

Other_____

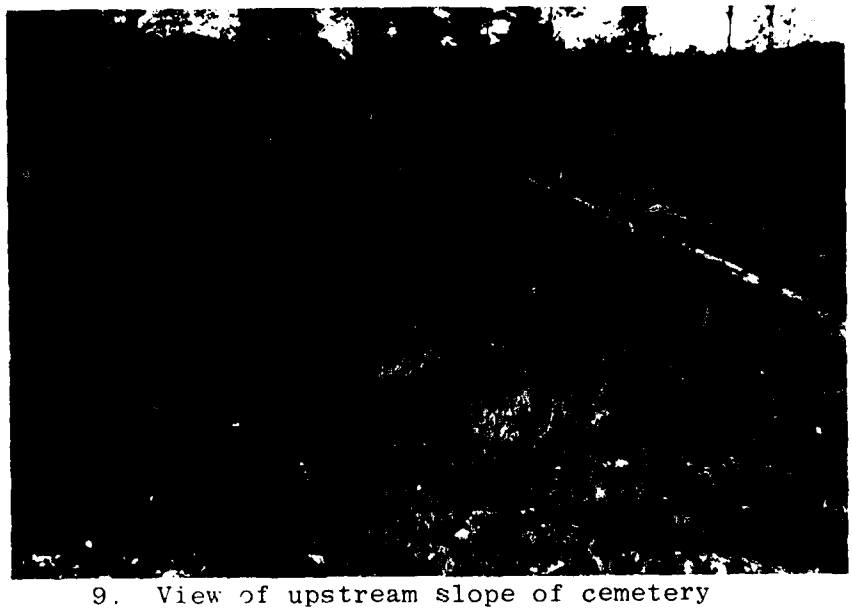
COMMENTS Stage in outlet channel inundating P.S. Pipe. _____

1/Looking downstream.
2/Including wave, surface, stream, manmade, and livestock erosion.

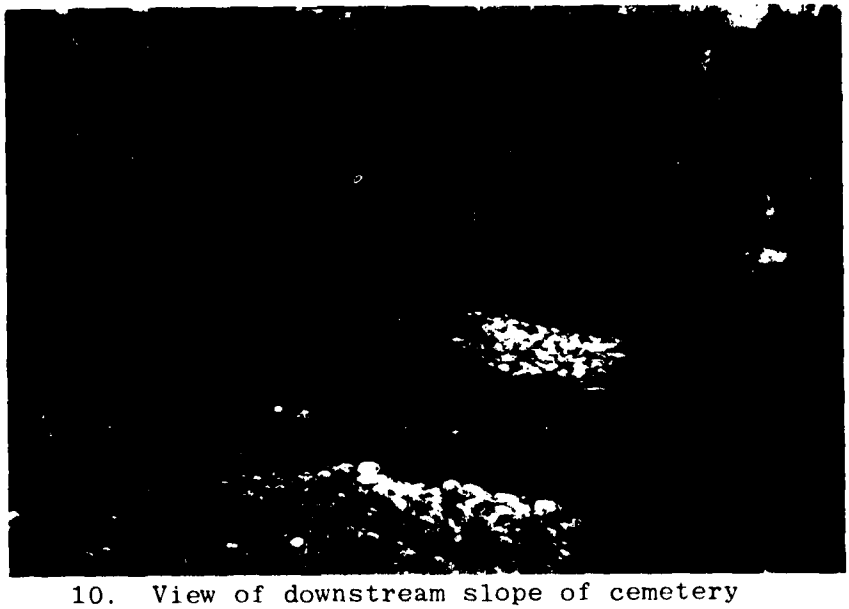
7. View of emergency spillway showing concrete sill with rock rip rap



8. View of south dike from right side



9. View of upstream slope of cemetery dike



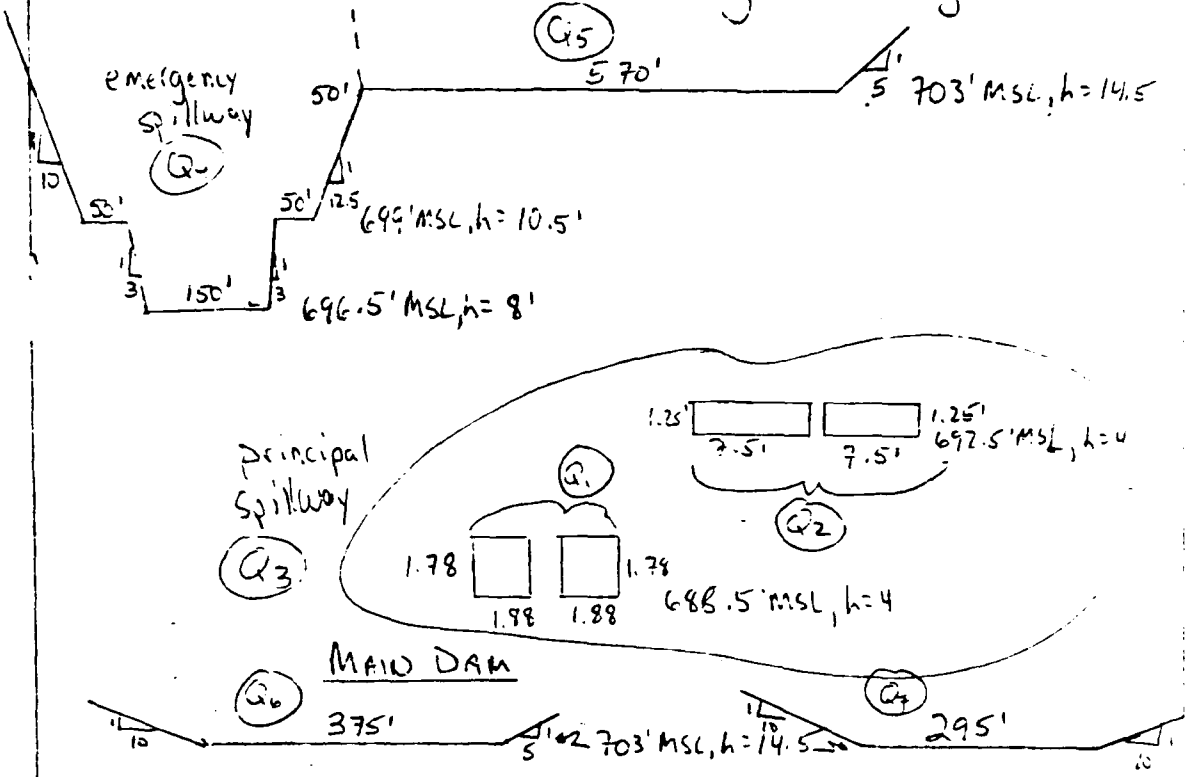
10. View of downstream slope of cemetery dike

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

183 Dam Sites Souhegan R. W. Dam # 8 TCS, 5/24/74

The information used to establish this elevation of Souhegan River Watershed Dam # 8 was determined from field notes and S.C.S. design drawings:



The 24" pond drain inlet is assumed closed for these calculations.

(Q1) : Q_1 is the lesser value of weir & orifice flow.

$Q_{1,weir} = 11.62\ h^{3/2}$

$Q_{1,orifice} = 32.14\ h^{\frac{1}{2}}$

from p. 7 of S.C.S Design calcs, dated 6-26-72

Q_2: Q_2 is weir flow (for higher stages the pipe on the riser controls). $Q_{2weir} = 46.5\ (h-4)^{3/2}$ S.C.S. calcs, 3-25-76

Q_3: is the lesser value of $Q_1 + Q_2$ or pipe flow ($= 24.91\ (h+3.5')^{\frac{1}{2}}$ assuming tailwater at 685'). The coefficient 24.91 is from S.C.S. Calcs. dated 3-25-76.

Q_4: The SCS developed this table of water surface elevation vs. emergency spillway flows:

elevation (Ft MSL)	Stage (h) (Ft above low flow outlet)	Stage above Emerg. Spillway crest (Ft)	Q (cfs)
696.5	8.0	0	0
696.98	8.48	.48	75
697.27	8.77	.77	150
697.59	9.09	1.09	300
697.87	9.37	1.37	450
698.10	9.60	1.60	600
698.31	9.81	1.81	750
698.51	10.01	2.01	900
698.84	10.34	2.34	1200
699.19	10.69	2.69	1500
699.90	11.40	3.40	2250
700.5	12.00	4.00	3000
701.07	12.57	4.57	3750
701.58	13.08	5.08	4500
702.50	14.00	6.00	6000
703.32	14.82	6.82	7500
704.09	15.59	7.59	9000
704.82	16.32	8.32	10,500

14 9 Dam Safety Southegan R.W. Dam #8 T(6.5/14/12, p 3

(Q5) for $h > 14.5$,

$$Q_5 = 2.6(570)(h-14.5)^{3/2} + 2.6(5)(h-14.5)(.5(h-14.5))^{3/2}$$

C=2.6 for broad-crested grass weir

(Q6) for $h > 14.5$,

$$Q_6 = 2.6(375)(h-14.5)^{3/2} + 2.6(10)(h-14.5)(.5(h-14.5))^{3/2} + 2.6(5)(h-14.5)(.5(h-14.5))^{3/2}$$

(Q7) for $h > 14.5$

$$Q_7 = 2.6(295)(h-14.5)^{3/2} + [2.6(10(h-14.5))(.5(h-14.5))^{3/2}]2$$

The BASIC Program which follows plots a Stage-Discharge Curve for Southegan River watershed Dam # 8.

```
LIST
100 REM - STAGE/DISCHARGE CURVE FOR SOUHEGAN RIV. WATERSHED DAM # 8
110 REM - STORED ON TAPE B-1 FILE 3
120 PAGE
130 REM - THE D1 ARRAY CONTAINS EMERGENCY SPILLWAY Q VS. H DATA
140 REM - N1 IS THE # OF Q VS. H POINTS
150 N1=18
160 DIM D1(2,N1)
170 DATA 8,8.48,8.77,9.09,9.37,9.6,9.81,10.01,10.34,10.69,11.4,12
180 DATA 12.57,13.08,14,14.82,15.59,16.32
190 FOR I=1 TO 18
200 READ D1(1,I)
210 NEXT I
220 DATA 0,75,150,300,450,600,750,900,1200,1500,2250,3000,3750,4500
230 DATA 6000,7500,9000,10500
240 FOR I=1 TO 18
250 READ D1(2,I)
260 NEXT I
270 PRINT USING 280:
280 IMAGE 10T"DISCHARGE FOR SOUHEGAN RIVER WATERSHED DAM NUMBER 8 "
290 PRINT USING 300:
300 IMAGE 10T" (AS A FUNCTION OF HEAD ABOVE THE LOW FLOW OUTLET)"
310 PRINT USING 320:
320 IMAGE // 2T"HEAD"3X"ELEVATION"30T"DISCHARGE"
330 PRINT USING 340:
340 IMAGE 1T"(FEET)"2X"(FT. MSL)"32T"(CFS)"
350 PRINT USING 360:
360 IMAGE 19T "TOTAL  PRINCIPAL  EMERGENCY   TOP OF   CEMETERY   EAST"
370 PRINT USING 380:
380 IMAGE 22T "    SPILLWAY   SPILLWAY     DAM       DIKE     DIKE"
390 FOR H=0 TO 16 STEP 0.5
400 Q2=0
410 Q3=0
420 Q4=0
430 Q5=0
```

```
440 Q6=0
450 Q7=0
460 REM - Q1 IS THE FLOW THROUGH THE LOW FLOW OUTLET
470 Q1=11.62*H↑1.5
480 Q=32.14*H↑0.5
490 IF Q>Q1 THEN 510
500 Q1=Q
510 IF H<4 THEN 540
520 REM - Q2 IS THE FLOW OVER THE TOP OF THE RISER
530 Q2=46.5*(H-4)↑1.5
540 Q3=Q1+Q2
550 Q=24.91*(H+3.5)↑0.5
560 IF Q>Q3 THEN 610
570 REM - Q3 IS THE TOTAL PRINCIPAL SPILLWAY OUTFLOW
580 REM -      IT CAN BE CONTROLLED BY THE ORIFICES OR BY THE PIPE UNDER
590 REM -      DAM.
600 Q3=Q
610 IF H<8 THEN 800
620 REM - THE EMERGENCY SPILLWAY FLOW (Q4) IS DETERMINED BY LINEAR
630 REM -   INTERPOLATION OF THE VALUES IN ARRAY D1.
640 IF H<D1(1,N1) THEN 680
650 REM - LINEAR EXTRAPOLATION BEYOND D1 CURVE
660 Q4=D1(2,N1)+(H-D1(1,N1))*(D1(2,N1)-D1(2,N1-1))/(D1(1,N1)-D1(1,N1-1))
670 GO TO 730
680 FOR I=1 TO N1
690 IF H=>D1(1,I) THEN 710
700 GO TO 720
710 NEXT I
720 Q4=D1(2,I-1)+(D1(2,I)-D1(2,I-1))*(H-D1(1,I-1))/(D1(1,I)-D1(1,I-1))
730 IF H<=14.5 THEN 800
740 REM - Q5 IS THE FLOW OVER THE TOP OF THE DAM
750 Q5=2.6*570*(H-14.5)↑1.5+2.6*5*(H-14.5)*(0.5*(H-14.5))↑1.5
760 REM - Q6 IS THE FLOW OVER THE CEMETERY DIKE
770 Q6=2.6*375*(H-14.5)↑1.5+2.6*15*(H-14.5)*(0.5*(H-14.5))↑1.5
780 REM - Q7 IS THE FLOW OVER THE EAST DIKE.
```

```
790 Q7=2.6*235*(H-14.5)↑1.5+2*2.6*10*(H-14.5)*(0.5*(H-14.5))↑1.5
800 T1=Q3+Q4+Q5+Q6+Q7
810 E=H+688.5
820 PRINT USING 830:H,E,T1,Q3,Q4,Q5,Q6,Q7
830 IMAGE 3D.1D,08D.1D,08D,09D,11D,09D,10D,09D
840 NEXT H
850 END
```

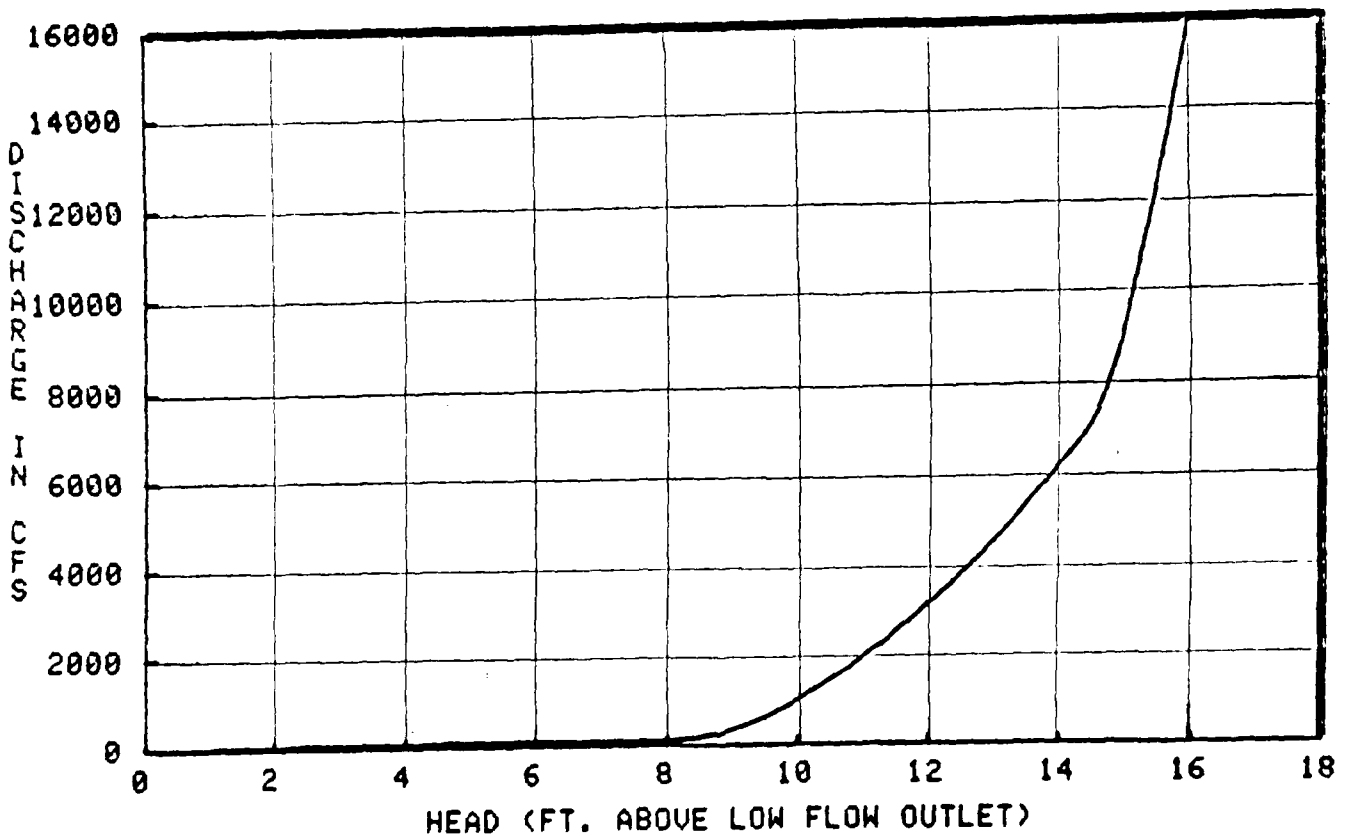
DISCHARGE FOR SOUHEGAN RIVER WATERSHED DAM NUMBER 8
(AS A FUNCTION OF HEAD ABOVE THE LOW FLOW OUTLET)

HEAD (FEET)	ELEVATION (FT. MSL)	DISCHARGE (CFS) TOTAL	PRINCIPAL SPILLWAY	EMERGENCY SPILLWAY	TOP OF DAM	CEMETERY DIKE	EAST DIKE
0.0	688.5	0	0	0	0	0	0
0.5	689.0	4	4	0	0	0	0
1.0	689.5	12	12	0	0	0	0
1.5	690.0	21	21	0	0	0	0
2.0	690.5	33	33	0	0	0	0
2.5	691.0	46	46	0	0	0	0
3.0	691.5	56	56	0	0	0	0
3.5	692.0	60	60	0	0	0	0
4.0	692.5	64	64	0	0	0	0
4.5	693.0	70	70	0	0	0	0
5.0	693.5	73	73	0	0	0	0
5.5	694.0	75	75	0	0	0	0
6.0	694.5	77	77	0	0	0	0
6.5	695.0	79	79	0	0	0	0
7.0	695.5	81	81	0	0	0	0
7.5	696.0	83	83	0	0	0	0
8.0	696.5	84	84	0	0	0	0
8.5	697.0	166	86	80	0	0	0
9.0	697.5	346	88	258	0	0	0
9.5	698.0	625	90	535	0	0	0
10.0	698.5	984	92	893	0	0	0
10.5	699.0	1430	93	1337	0	0	0
11.0	699.5	1922	95	1827	0	0	0
11.5	700.0	2471	96	2375	0	0	0
12.0	700.5	3098	98	3000	0	0	0
12.5	701.0	3758	100	3658	0	0	0
13.0	701.5	4484	101	4382	0	0	0

P.7

13.5	702.0	5287	103	5185	0	0	0
14.0	702.5	6104	104	6000	0	0	0
14.5	703.0	7020	106	6915	0	0	0
15.0	703.5	9104	107	7851	525	347	274
15.5	704.0	12194	109	8825	1487	989	785
16.0	704.5	15977	110	9842	2735	1829	1460

STAGE-DISCHARGE CURVE FOR SOUHEGAN R. W. DAM # 8



183 Dam Safety Southegan R.W Dam #8 TLG, 5/25/79

Storage-Elevation Curve

The S.C.S. gives Storage-Elevation data on a Hydrologic and Hydraulic Calc. sheet dated 5/12/76

elevation (Ft msl)	Stage (h) (Ft above low flow outlet)	Current Storage (Ac-Ft.)	Available Storage (Ac-Ft.)
688.5	0	0	0
689	.5	20	20
690	1.5	42	42
691	2.5	125	122
692	3.5	230	224
692.5	4	280	272
693	4.5	350	341
694	5.5	500	488
695	6.5	675	660
696	8	960	941
697.5	9	1170	1151
699	10.5	1520	1501
700	11.5	1757	1738
701	12.5	2020	2001
702	13.5	2280	2261
703	14.5	2560	2541
704	15.5	2850	2831
[illegible]	[illegible]	[illegible]	3106

1 " of runoff = $\frac{1}{12}(640)(4.44) = 236.8$ ac-ft.

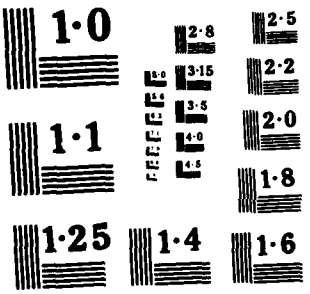
1 AC-FT = $\frac{1}{236.8}$ = .00422 " of runoff.

Storage at em. s/w crest = (960)(.00422) = 4.05"

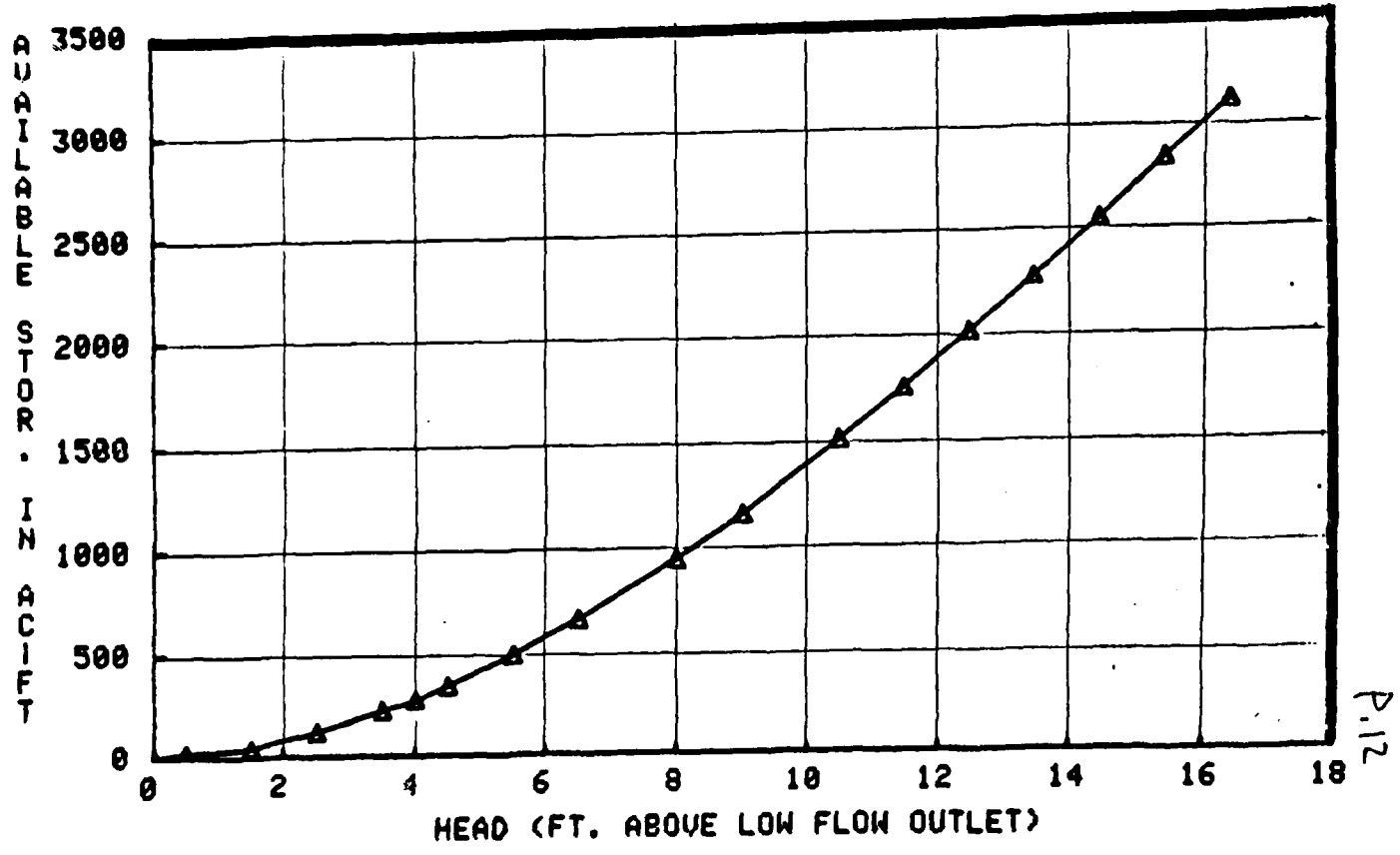
Storage at dam crest = (2560)(.00422) = 10.80"

AD-A156 839 NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS SOUHEGAN RIVER WATERS..(U) CORPS OF ENGINEERS WALTHAM MA NEW ENGLAND DIV AUG 79 2/2

UNCLASSIFIED F/G 13/13 NL


1·0
1·1
1·25
2·8
3·15
3·5
4·0
4·5
2·5
2·2
2·0
1·8
1·4
1·6

STORAGE-ELEVATION CURVE FOR SOUHEGAN R. W. DAM # 8



P.12

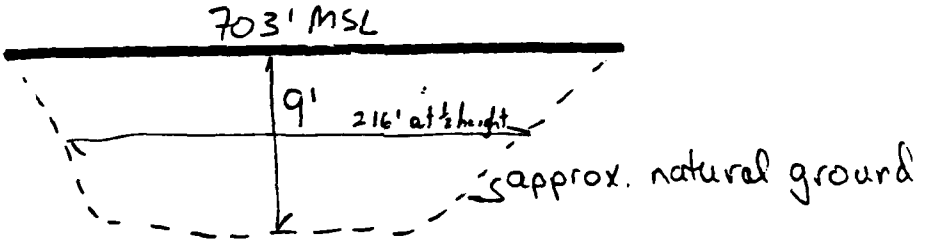
Dam Failure Analysis

P. 13 is a Location and Downstream Hazard Map for S.R.W. Dam # 8.

There are three dikes associated with this dam: The critical failure would be the main dam, but we will look quickly at the effects of failure of the others.

South Dike (or east dike)

This Dike separates the drainage area of Southegan River Watershed Dam # 8 from that of SRWD #33:



Assume failure with watersurface at 699 MSL (see p. 16)

$$Q_{p_1} = 8/27\ (.4(216))\ \sqrt{g}\ (5)^{3/2}$$

W_b = breach width = .4 width at ½ height

y_0 = height above tailwater or natural ground

Q_{p_1} = 1625 cfs. This is the peak dam failure outflow.

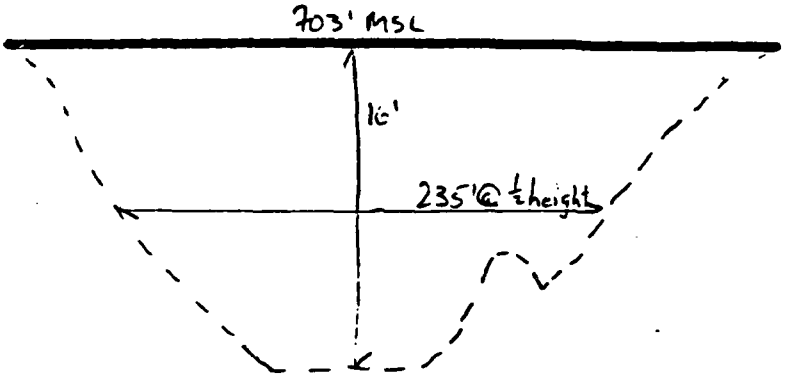
The volume released = Storage at 699 - storage at 694

= 1520 - 500 = 1020 Ac-ft.

Inflows of this magnitude could endanger SRW Dam # 33 which has storage of 900 ac-ft and peak outflow of 2100 cfs (top of dam).

Cemetery Dike

This dike is about 1000 ft. South of the main dam, across Cemetery Road:



Assume failure with water surface at 699' MSL (see p. 16)

$$Q_p = 8/27 \sqrt{g} \; (.4\,(235)) \; (12)^{3/2}$$

(w_b = .4(235), y_o = 12)

$$= 6570 \text{ cfs}.$$

There is no well-defined channel downstream, so it is difficult to predict the extent of flooding. This flow would eventually reenter Furnace Brook. There is one house about 1300 ft. downstream of Cemetery Dike (just upstream of Cran Hill Rd.) which might be effected by the flow before it rejoins the brook.

Volume released = Storage @ 699 - Storage @ 697

= 1520 - 0 = 1520 ac-ft.

Main Dam

The first question to be addressed in the Dam Failure Analysis is the assumed water surface elevation at failure. The normal assumption is that failure occurs with the water surface at the top of the dam. This would yield a pre-failure outflow of 7020 cfs, which would cause serious flooding downstream prior to dam failure. This flow is also greater than the routed PMF outflow at the dam. Dam failure would have a greater incremental impact if it were to occur with a lower water surface elevation in the reservoir. Therefore, for this analysis failure is assumed to occur with the water surface at SCS Design High Water, 699 ft. MSL, h= 10.5 ft., 4.0 ft. below the dam crest. This would create a pre-failure outflow of 1430 cfs. Current storage at this elevation is 1520 ac-ft.

Peak failure outflow = Normal outflow + Breach outflow

Normal Outflow = 1430 cfs

Breach outflow = $Q_{p_1} = \frac{8}{27}\sqrt{g}\, W_b y_o^{3/2}$

Where: W_b = breach width = 40% of dam width at ½ height of dam = .4(210) = 84 ft. (Width from sheet 5 of SCS plans)

y_o = height above tailwater at failure. Tailwater of SRWD #8 seems to be controlled by beaver dams 200'± downstream

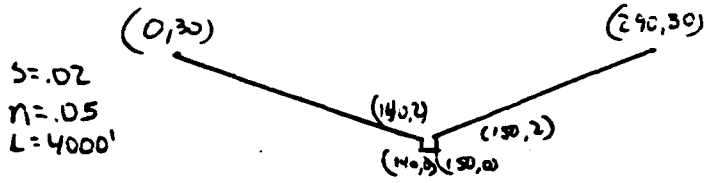
of outlet. At low flows the tailwater depth is about 4 ft. (above 680.86 → 685±). At the pre-failure flow of 1430 cfs this is unlikely to change significantly, because most of the outflow is to the emergency spillway, which rejoins Furnace Brook about 800 ft. downstream of the principal spillway outlet, downstream of the Beaver dams.

Therefore: $Y_o = 699 - 685 = 14$ ft.

$$Q_{p_1} = \frac{8}{27}\sqrt{g}\,(84)(14)^{3/2} = 7400 \text{ cfs}$$

Peak dam failure flow = 7400 + 1430 = 8830 cfs

For about 4000 ft. downstream of the dam, Furnace Brook is a mountain stream - steep and in a narrow channel. The only development in this reach from the dam to the Boston and Maine Railroad Bridge is two secondary roads which cross the brook on culverted embankments. The following typical cross-section is based on field notes and USGS topo information.



A Stage-Normal flow relationship for this reach is given on p.18. The pre-failure flow of 1430 cfs would create a stage of 6.7 feet in this reach, which would overtop the two midway embankments. The attenuation due to

DEPTH	ELEV	AREA	WPER	HYD-R	AR2/3	Q
0.00	0.0	0.0	0.0	0.0	0.0	0.0
1.00	1.0	10.0	12.0	0.8	8.9	37.3
2.00	2.0	20.0	14.0	1.4	25.4	106.9
3.00	3.0	35.0	24.2	1.4	44.8	188.7
4.00	4.0	60.0	34.4	1.7	87.0	366.5
5.00	5.0	95.0	44.6	2.1	157.3	663.0
6.00	6.0	140.0	54.8	2.6	261.7	1103.1
7.00	7.0	195.0	65.0	3.0	405.8	1710.2
8.00	8.0	260.0	75.2	3.5	594.8	2506.7
9.00	9.0	335.0	85.4	3.9	833.7	3513.5
10.00	10.0	420.0	95.6	4.4	1127.3	4750.8
11.00	11.0	515.0	105.8	4.9	1480.1	6237.8
12.00	12.0	620.0	116.0	5.3	1896.6	7992.9
13.00	13.0	735.0	126.2	5.8	2380.9	10034.0
14.00	14.0	860.0	136.4	6.3	2937.2	12378.5
15.00	15.0	995.0	146.6	6.8	3569.5	15043.2
16.00	16.0	1140.0	156.8	7.3	4281.7	18044.6
17.00	17.0	1295.0	167.0	7.8	5077.5	21398.5
18.00	18.0	1460.0	177.2	8.2	5960.8	25120.8
19.00	19.0	1635.0	187.4	8.7	6935.0	29226.7
20.00	20.0	1820.0	197.6	9.2	8003.9	33731.2
21.00	21.0	2015.0	207.8	9.7	9170.8	38649.2
22.00	22.0	2220.0	218.0	10.2	10439.3	43995.0
23.00	23.0	2435.0	228.2	10.7	11812.7	49783.0
24.00	24.0	2660.0	238.4	11.2	13294.3	56027.1
25.00	25.0	2895.0	248.6	11.6	14887.5	62741.2
26.00	26.0	3140.0	258.8	12.1	16595.4	69938.9
27.00	27.0	3395.0	269.0	12.6	18421.2	77633.5
28.00	28.0	3660.0	279.1	13.1	20368.1	85838.4
29.00	29.0	3935.0	289.3	13.6	22439.1	94566.6
30.00	30.0	4220.0	299.5	14.1	24637.4	103830.9

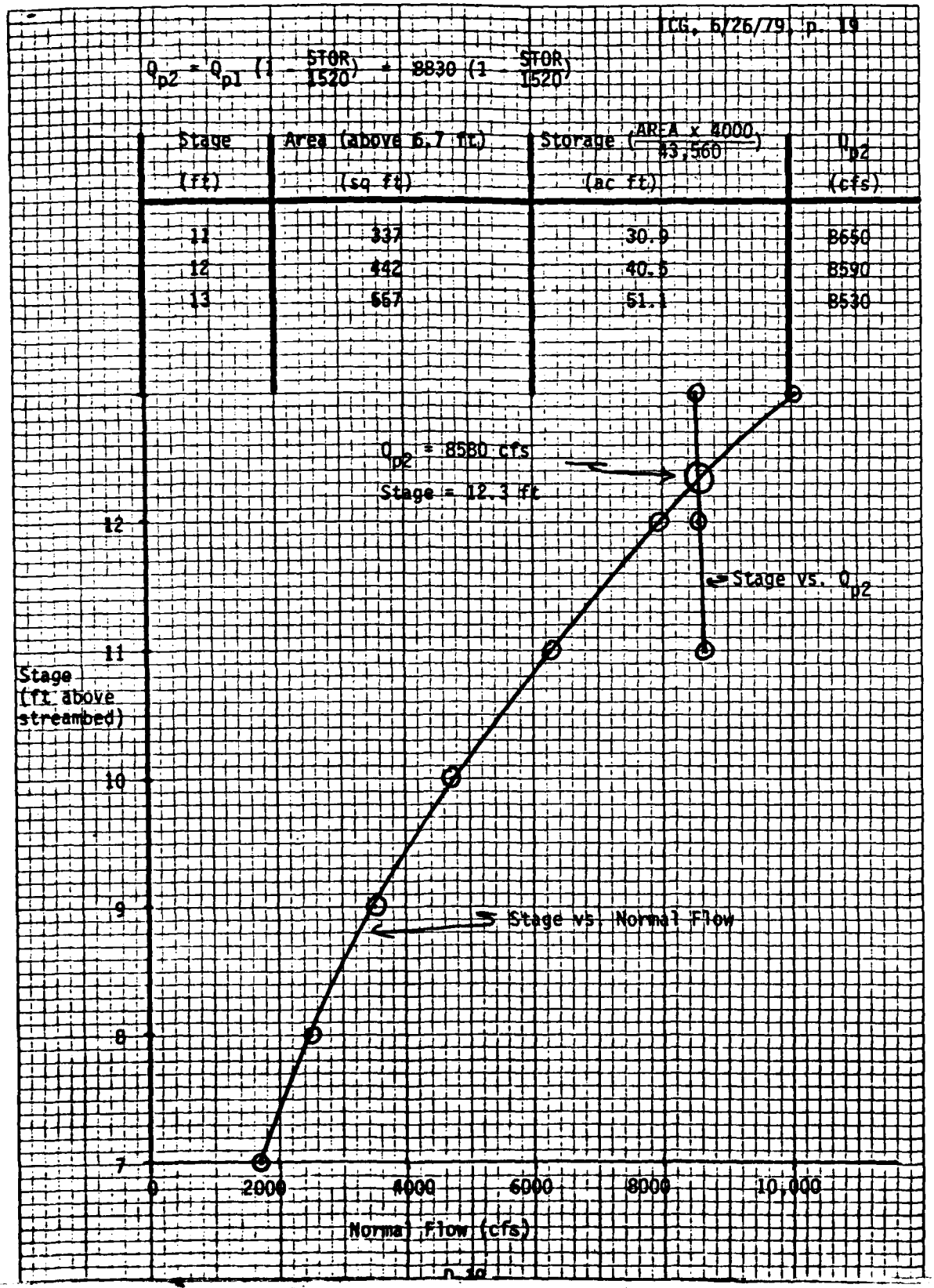
REACH FROM DAM TO BOSTON AND MAINE RAILROAD BRIDGE

Attenuated Peak Dam Failure Flow at Boston & Maine Railroad Bridge

[CG, 6/26/79, p. 19

$$Q_{p2} = Q_{p1}\left(1 - \frac{STOR}{1520}\right) + 8830\left(1 - \frac{STOR}{1520}\right)$$

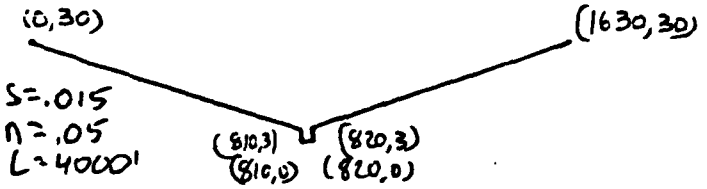
Stage (ft)	Area (above 6.7 ft) (sq ft)	Storage $\left(\frac{AREA \times 4000}{43,560}\right)$ (ac ft)	Q_{p2} (cfs)
11	337	30.9	8650
12	442	40.6	8590
13	557	51.1	8530



Storage in this reach is calculated on p. 19. The attenuated peak dam failure flow at the railroad would be 8580 cfs, which would create a stage of 12.3 ft. in this reach. This would severely overtop and probably damage or destroy the two road crossings in the reach.

The railroad bridge itself has about a 40' wide x 30' high opening. Therefore, it should neither restrict flows a great deal nor be threatened by dam failure stage.

Downstream of this bridge, Furnace Brook is flatter, with a wider floodplain for the 4000' to its confluence with Stony Brook. There is some development in this reach. Just downstream of the railroad bridge there are three houses about 20 feet above the streambed (500 ft. from the stream). At the downstream end of the reach there is another house 15-20' up. The B&M railroad and New Hampshire Highway 31 both parallel Furnace Brook well above the stream. The following typical cross-section for the reach is based on field notes and USGS quad information.



A Stage-Normal Flow relationship for this reach is given on p 21. The pre-failure flow of 1430 cfs would create a stage of 5.7 ft. in the reach. The attenuation due to storage is calculated on p. 22.

DEPTH	ELEV	AREA	WPER	HYD-R	AR2/3	Q
0.00	0.0	0.0	0.0	0.0	0.0	0.0
1.00	1.0	10.0	12.0	0.8	8.9	32.3
2.00	2.0	20.0	14.0	1.4	25.4	92.6
3.00	3.0	30.0	16.0	1.9	45.6	166.5
4.00	4.0	70.0	76.0	0.9	66.2	241.8
5.00	5.0	170.0	136.1	1.2	197.2	719.8
6.00	6.0	330.0	196.1	1.7	467.0	1704.3
7.00	7.0	550.0	256.1	2.1	915.7	3341.9
8.00	8.0	830.0	316.2	2.6	1580.0	5766.6
9.00	9.0	1170.0	376.2	3.1	2493.8	9101.7
10.00	10.0	1570.0	436.2	3.6	3688.7	13462.8
11.00	11.0	2030.0	496.3	4.1	5194.6	18959.0
12.00	12.0	2550.0	556.3	4.6	7040.1	25694.7
13.00	13.0	3130.0	616.3	5.1	9252.6	33769.7
14.00	14.0	3770.0	676.4	5.6	11858.5	43280.4
15.00	15.0	4470.0	736.4	6.1	14883.3	54320.0
16.00	16.0	5230.0	796.4	6.6	18351.7	66978.8
17.00	17.0	6050.0	856.5	7.1	22287.9	81344.9
18.00	18.0	6930.0	916.5	7.6	26715.3	97503.9
19.00	19.0	7870.0	976.5	8.1	31656.9	115539.5
20.00	20.0	8870.0	1036.6	8.6	37135.2	135533.7
21.00	21.0	9930.0	1096.6	9.1	43172.0	157566.6
22.00	22.0	11050.0	1156.6	9.6	49789.0	181716.9
23.00	23.0	12230.0	1216.7	10.1	57007.3	208061.8
24.00	24.0	13470.0	1276.7	10.6	64847.7	236677.2
25.00	25.0	14770.0	1336.7	11.0	73330.6	267637.7
26.00	26.0	16130.0	1396.8	11.5	82476.3	301016.9
27.00	27.0	17550.0	1456.8	12.0	92304.4	336886.9
28.00	28.0	19030.0	1516.8	12.5	102834.5	375319.3
29.00	29.0	20570.0	1576.9	13.0	114086.0	416384.2
30.00	30.0	22170.0	1636.9	13.5	126077.8	460151.2

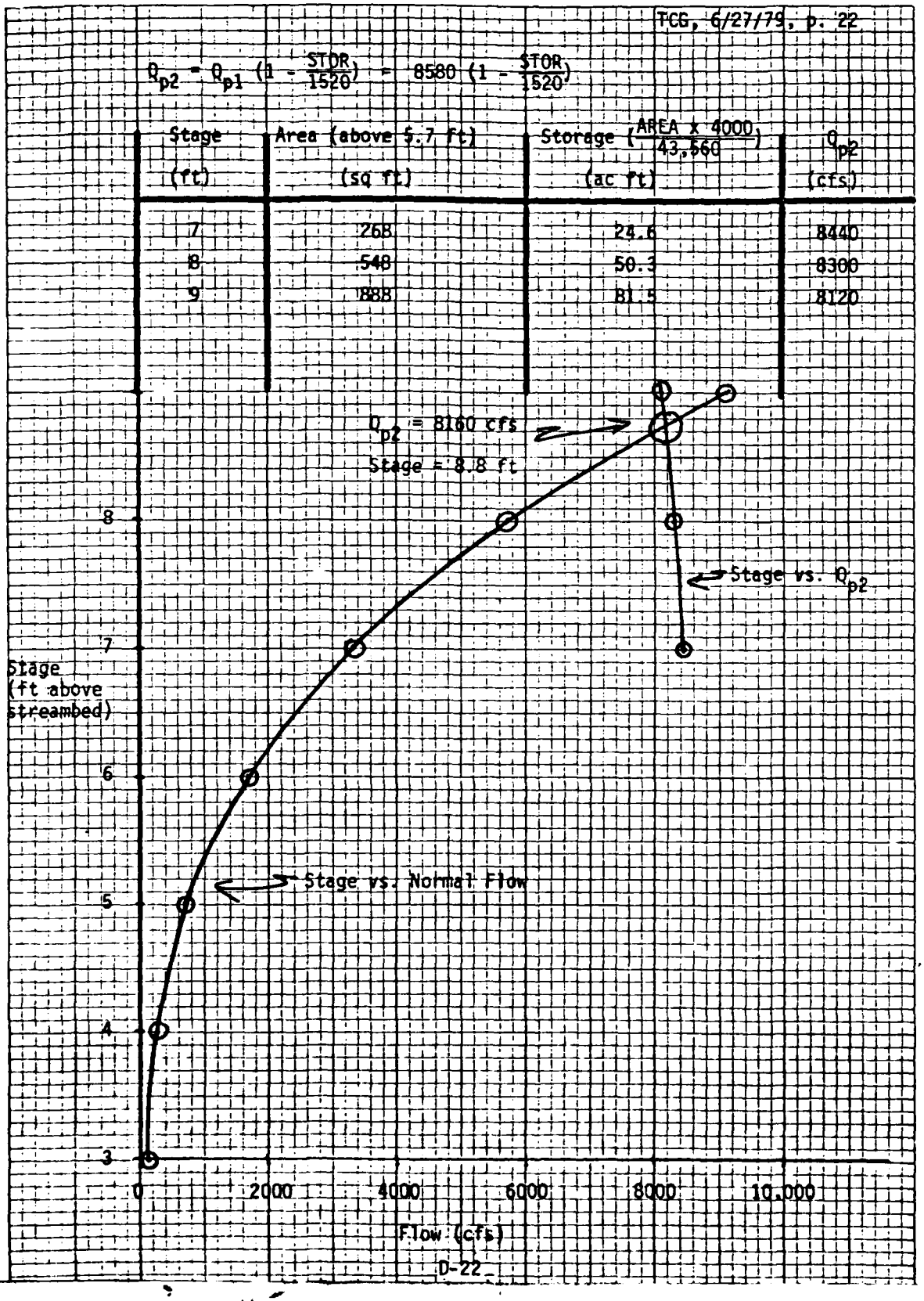
REACH FROM BOSTON AND MAINE R/R BRIDGE TO STONY BROOK

Attenuated Peak Dam Failure Flow at Confluence with Stony Brook

TCG, 6/27/79, p. 22

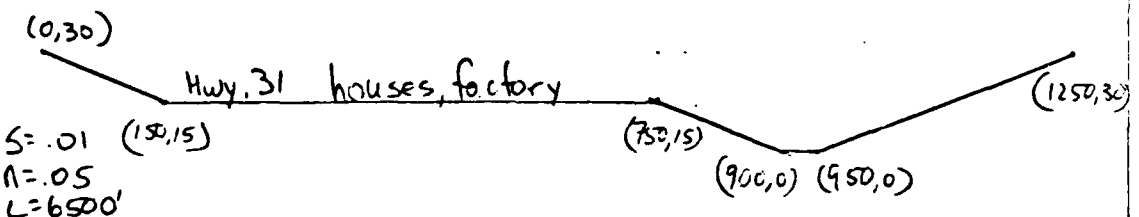
$$Q_{p2} = Q_{p1}\left(1 - \frac{STOR}{1520}\right) = 8580\left(1 - \frac{STOR}{1520}\right)$$

Stage (ft)	Area (above 5.7 ft) (sq ft)	Storage $\left(\frac{AREA \times 4000}{43,560}\right)$ (ac ft)	Q_{p2} (cfs)
7	268	24.6	8440
8	548	50.3	8300
9	888	81.5	8120



The attenuated peak dam failure flow at the confluence with Stony Brook would be 8160 cfs, yielding a stage of 8.8 ft. This would not cause significant damage in this reach.

After Furnace Brook enters Stony Brook, Stony Brook flows about 6500 ft. before it is joined by Stockwell Brook. This reach has a broad stream, with an extensive flat area to one side (the southwest) about 15 ft. above the streambed. This flat area contains some development - 1-5 houses and a large large factory-type building (under construction), as well as N.H. Highway 31. The B&M railroad runs well above the stream on the other side. The following typical cross-section for this reach is based on field notes and USGS topo information.



A Stage-Normal Flow relationship for this reach is given on p. 24. The pre-failure flow of 1930 cfs (assumes 500 cfs inflow from Stony Brook) would create a stage of 3.8 ft. in this reach. The attenuation due to storage in the reach is calculated on p. 25.

DEPTH	ELEV	AREA	WPER	HYD-R	AR2/3	Q
0.00	0.0	0.0	0.0	0.0	0.0	0.0
1.00	1.0	60.0	70.1	0.9	54.1	161.2
2.00	2.0	140.0	90.2	1.6	187.7	559.4
3.00	3.0	240.0	110.3	2.2	403.1	1201.2
4.00	4.0	360.0	130.4	2.8	708.7	2112.0
5.00	5.0	500.0	150.5	3.3	1113.7	3318.8
6.00	6.0	660.0	170.6	3.9	1627.2	4849.2
7.00	7.0	840.0	190.7	4.4	2258.3	6729.7
8.00	8.0	1040.0	210.8	4.9	3015.6	8986.5
9.00	9.0	1260.0	230.9	5.5	3907.7	11644.8
10.00	10.0	1500.0	251.0	6.0	4942.7	14729.3
11.00	11.0	1760.0	271.1	6.5	6128.8	18263.8
12.00	12.0	2040.0	291.2	7.0	7473.8	22271.9
13.00	13.0	2340.0	311.3	7.5	8985.4	26776.4
14.00	14.0	2660.0	331.4	8.0	10671.0	31799.6
15.00	15.0	3000.0	351.5	8.5	12538.1	37363.6
16.00	16.0	3960.0	971.6	4.1	10108.9	30124.6
17.00	17.0	4940.0	991.7	5.0	14416.5	42961.0
18.00	18.0	5940.0	1011.8	5.9	19342.2	57639.7
19.00	19.0	6960.0	1031.9	6.7	24861.9	74088.5
20.00	20.0	8000.0	1052.0	7.6	30957.6	92253.8
21.00	21.0	9060.0	1072.1	8.5	37615.5	112094.3
22.00	22.0	10140.0	1092.2	9.3	44824.9	133578.2
23.00	23.0	11240.0	1112.3	10.1	52577.4	156680.6
24.00	24.0	12360.0	1132.4	10.9	60866.5	181382.2
25.00	25.0	13500.0	1152.5	11.7	69687.3	207668.1
26.00	26.0	14660.0	1172.6	12.5	79035.8	235526.7
27.00	27.0	15840.0	1192.7	13.3	88909.3	264949.7
28.00	28.0	17040.0	1212.8	14.1	99305.7	295930.9
29.00	29.0	18260.0	1232.9	14.8	110223.6	328466.3
30.00	30.0	19500.0	1253.0	15.6	121662.3	362553.7

p.2d

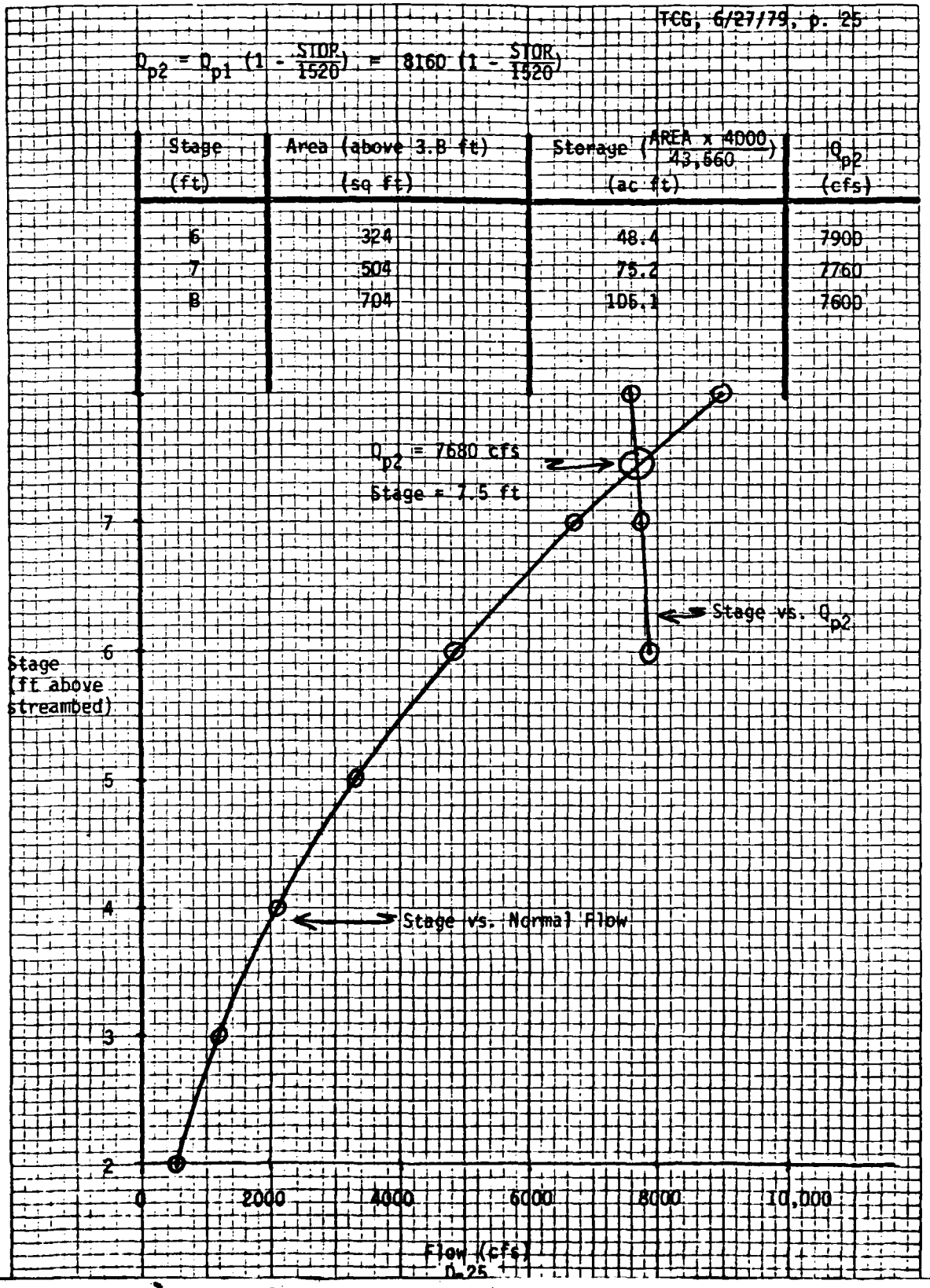
REACH FROM CONFLUENCE WITH STONY BROOK TO CONFLUENCE WITH STOCKWELL BK.

Attenuated Peak Dam Failure Flow at Confluence of Stony and Stockwell Brooks

TCG, 6/27/79, p. 25

$$Q_{p2} = Q_{p1}\left(1 - \frac{STOR}{1520}\right) = 8160\left(1 - \frac{STOR}{1520}\right)$$

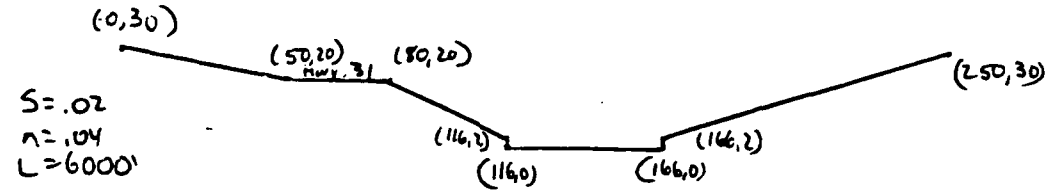
Stage (ft)	Area (above 3.8 ft) (sq ft)	Storage $\left(\frac{AREA \times 4000}{43{,}560}\right)$ (ac ft)	Q_{p2} (cfs)
6	324	48.4	7900
7	504	75.2	7760
8	704	105.1	7600



D-25

The attenuated peak dam failure flow at the confluence of Stony and Stockwell Brooks would be 7680 cfs, yielding a stage of 7.5 ft. This would not cause significant damage in this reach, although at least one dirt road crosses the stream on a low bridge which would probably be overtopped. This flow does not include any assumed inflow from Stony Brook which would make dam failure flows higher and increase downstream damages. If the inflow were on the order of 500 cfs, this increase would be small.

Downstream of the confluence with Stockwell Brook, Stony Brook flows about 6000 ft. to the town of Wilton. The brook is paralleled by N.H. Highway 31, and crossed by the B&M railroad (on a high trestle). The following typical cross-section is based on field notes and USGS topo information



A Stage-Normal Flow relationship for this reach is given on p. 27. The pre-failure flow of 2430 cfs (assuming 500 cfs inflow from Stockwell Brook) would create a stage of about 4.0 ft. in this reach. The attenuation due to storage in the reach is calculated on p. 28.

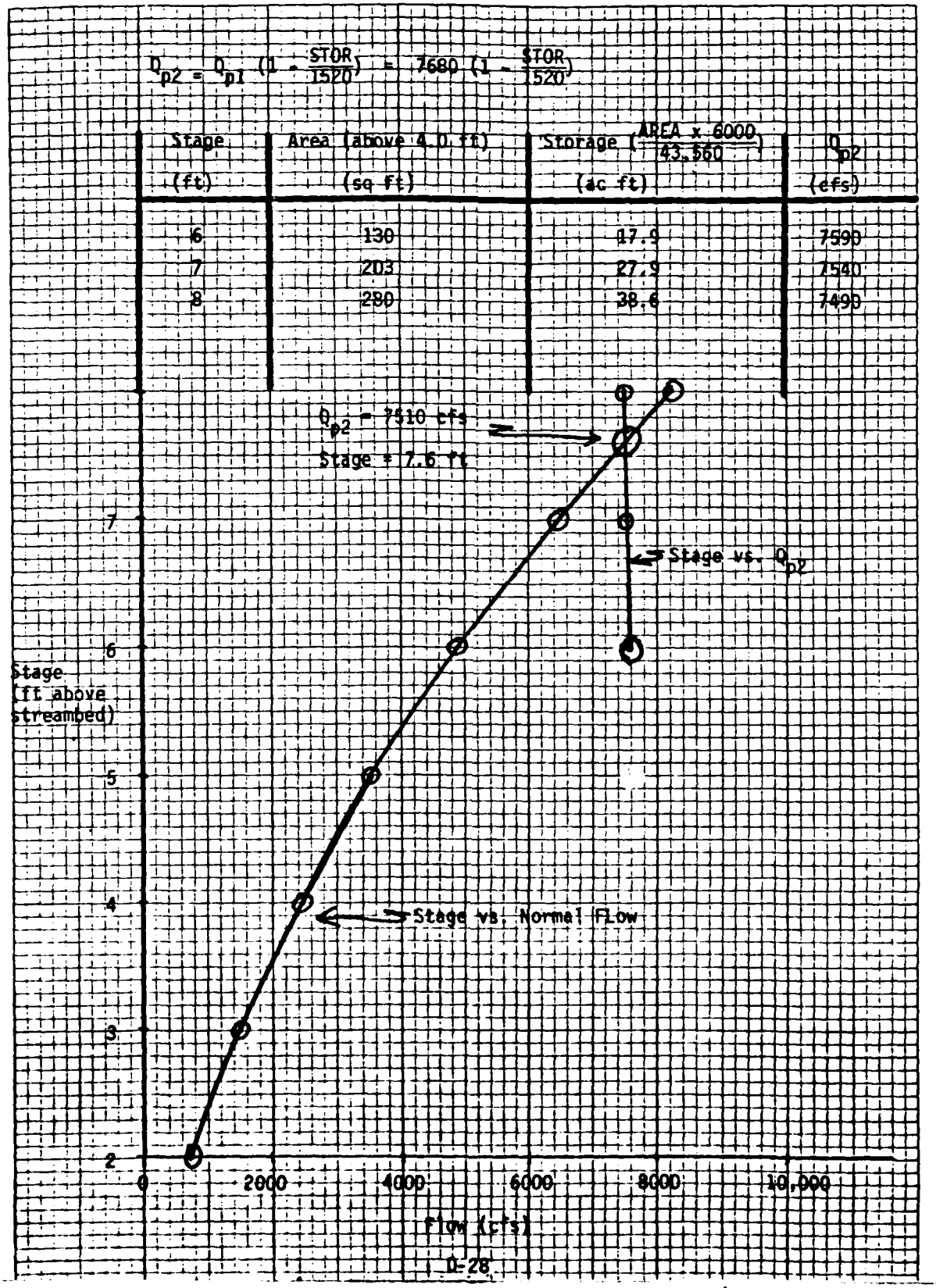
The attenuated peak dam failure flow at the downstream end of this reach is 7510 cfs, which creates a stage of 7.6 ft. This would cause little damage in this reach. This flow does not include any assumed inflow from Stockwell Brook, which would make dam failure flows higher and increase downstream damages. If the

DEPTH	ELEV	AREA	WPER	HYD-R	AR2/3	Q
0.00	0.0	0.0	0.0	0.0	0.0	0.0
1.00	1.0	50.0	52.0	1.0	48.7	256.6
2.00	2.0	100.0	54.0	1.9	150.8	794.6
3.00	3.0	152.5	59.4	2.6	286.0	1506.8
4.00	4.0	210.0	64.8	3.2	460.1	2423.7
5.00	5.0	272.5	70.2	3.9	673.4	3547.4
6.00	6.0	340.0	75.6	4.5	926.9	4882.8
7.00	7.0	412.5	81.0	5.1	1221.7	6436.1
8.00	8.0	490.0	86.4	5.7	1559.3	8214.4
9.00	9.0	572.5	91.8	6.2	1941.0	10225.2
10.00	10.0	660.0	97.2	6.8	2368.3	12476.3
11.00	11.0	752.5	102.6	7.3	2842.8	14975.6
12.00	12.0	850.0	108.0	7.9	3365.8	17731.0
13.00	13.0	952.5	113.4	8.4	3939.0	20750.5
14.00	14.0	1060.0	118.8	8.9	4563.8	24042.1
15.00	15.0	1172.5	124.2	9.4	5241.8	27613.6
16.00	16.0	1290.0	129.6	10.0	5974.4	31473.0
17.00	17.0	1412.5	135.0	10.5	6763.2	35628.1
18.00	18.0	1540.0	140.4	11.0	7609.5	40086.6
19.00	19.0	1672.5	145.8	11.5	8514.9	44856.2
20.00	20.0	1810.0	151.2	12.0	9480.8	49944.5
21.00	21.0	1984.0	189.4	10.5	9504.8	50070.6
22.00	22.0	2166.0	197.7	11.0	10693.4	56332.4
23.00	23.0	2356.0	206.0	11.4	11971.0	63062.7
24.00	24.0	2554.0	214.2	11.9	13340.1	70275.0
25.00	25.0	2760.0	222.5	12.4	14803.2	77982.6
26.00	26.0	2974.0	230.7	12.9	16362.8	86198.6
27.00	27.0	3196.0	239.0	13.4	18021.4	94935.8
28.00	28.0	3426.0	247.3	13.9	19781.4	104207.1
29.00	29.0	3664.0	255.5	14.3	21645.1	114025.1
30.00	30.0	3910.0	263.8	14.8	23614.9	124402.2

REACH FROM STOCKWELL BROOK TO WILTON

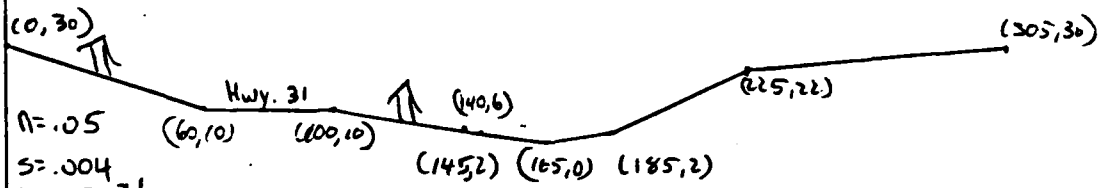
$$Q_{p2} = Q_{p1}\left(1 - \frac{STOR}{1520}\right) = 7680\left(1 - \frac{STOR}{1520}\right)$$

Stage (ft)	Area (above 4.0 ft) (sq ft)	Storage $\left(\frac{AREA \times 6000}{43,560}\right)$ (ac ft)	Q_{p2} (cfs)
6	130	17.9	7590
7	203	27.9	7540
8	280	38.6	7490



inflow is on the order of 500 cfs, this increase would not be large.

At the outskirts of Wilton, Stony Brook becomes much less steep. The brook is paralleled by Highway 31, and there is a row of houses between the highway and the stream. The first floors of these houses are quite close to Stony Brook. There are nine houses with first floors 7'-12' above the streambed, and two about 18 ft. up. This reach also includes an apartment building about 12 ft. above the streambed an a laundry about 10 ft. up. Across Highway 31 there are numerous (20+) houses and businesses about 25 ft. above the streambed. This reach runs about 1500 ft. to the confluence with the Souhegan River. The typical cross-section for this reach given below is based on USGS topo information and field notes.



Attenuation in this short reach is assumed to be negligible. The pre-failure flow of 2430 cfs would result in a stage of 9.1 feet, which would cause 0-2 ft. of flooding at the nine low-lying houses. The peak dam failure flow of 7510 cfs would result in a stage of 13.9 ft. in this reach, increasing flooding by 5 ft. to 2-7 ft. at the low lying houses, to 4 ft at the laundry, and to 2 ft. at the apartment. (See Stage-Normal Flow, p. 30)

DEPTH	ELEV	AREA	WPER	HYD-R	AR2/3	Q
0.00	0.0	0.0	0.0	0.0	0.0	0.0
1.00	1.0	10.0	20.1	0.5	6.3	11.8
2.00	2.0	40.0	40.2	1.0	39.9	75.1
3.00	3.0	81.6	44.0	1.9	123.2	232.2
4.00	4.0	126.5	47.9	2.6	241.9	455.8
5.00	5.0	174.6	51.7	3.4	393.2	741.1
6.00	6.0	226.0	55.5	4.1	576.2	1086.1
7.00	7.0	285.0	67.8	4.2	742.4	1399.3
8.00	8.0	356.0	80.1	4.4	962.7	1814.4
9.00	9.0	439.0	92.4	4.8	1241.3	2339.5
10.00	10.0	534.0	104.7	5.1	1583.2	2983.9
11.00	11.0	677.5	150.1	4.5	1851.4	3489.4
12.00	12.0	826.0	155.5	5.3	2516.2	4742.3
13.00	13.0	979.5	160.9	6.1	3267.8	6158.9
14.00	14.0	1138.0	166.3	6.8	4104.7	7736.2
15.00	15.0	1301.5	171.7	7.6	5025.9	9472.5
16.00	16.0	1470.0	177.1	8.3	6031.0	11366.7
17.00	17.0	1643.5	182.5	9.0	7119.7	13418.5
18.00	18.0	1822.0	187.9	9.7	8292.0	15628.1
19.00	19.0	2005.5	193.3	10.4	9548.3	17995.8
20.00	20.0	2194.0	198.7	11.0	10888.8	20522.4
21.00	21.0	2387.5	204.1	11.7	12314.2	23208.7
22.00	22.0	2586.0	209.5	12.3	13824.9	26056.1
23.00	23.0	2793.5	222.7	12.5	15094.6	28449.1
24.00	24.0	3014.0	235.9	12.8	16486.5	31072.4
25.00	25.0	3247.5	249.1	13.0	18003.7	33932.0
26.00	26.0	3494.0	262.3	13.3	19649.9	37034.4
27.00	27.0	3753.5	275.5	13.6	21428.5	40386.6
28.00	28.0	4026.0	288.7	13.9	23343.3	43995.6
29.00	29.0	4311.5	302.0	14.3	25398.2	47868.5
30.00	30.0	4610.0	315.2	14.6	27597.0	52012.5

REACH IN WILTON

P-30

P.30

This sudden rise would present a threat of loss of life, especially at the houses. It would also flood (by about 4 ft.) and possibly damage Highway 31 in this area.

Downstream of the residences and still in the town of Wilton, Stony Brook passes over Abbot Memorial Trust Dam and flows into the Souhegan River. The resulting flow in the Souhegan would depend on antecedent flow conditions in the river. Stony Brook would contribute a peak dam failure flow of 7510 cfs (5080 cfs above pre-failure flow). This could affect the 5-10 homes and businesses along the Souhegan in Wilton, although dam failure flows would attenuate rapidly. Downstream of Milford the Souhegan flows through about 5 miles of broad flood plain before entering the town of Milford. It is expected that dam failure outflow would essentially be attenuated in this reach.

In summary, the only major impacts of the failure of SRWD #8 would be a serious increase to flooding and the threat of loss of life in Wilton on Stony Brook, and possible flooding on the Souhegan River in Wilton.

TEST FLOOD ANALYSIS

Size Classification: Intermediate

Hazard Classification: High

The hazard classification is HIGH due to the potential for serious economic losses and loss of life along Stony Brook in Wilton in the event of dam failure.

Test Flood = PMF

Using the COE NED "Maximum Probable Flood Peak Flow Rates," the upstream drainage area of 4.44 sq. mi. with rolling terrain would yield a PMF peak inflow of 1890 csm.

Peak inflow = 4.44 (1890) = 8390 cfs.

Attenuation due to storage in the reservoir is calculated on p. 33, assuming the water surface elevation begins at 691.5 ft. MSL, the 5½* day drawdown elevation. (See p. 34). The attenuated peak test flood outflow is 5040 cfs, which yields an elevation of 701.7 ft, 13.2 ft above normal pool and 1.3 feet below the dam crest.

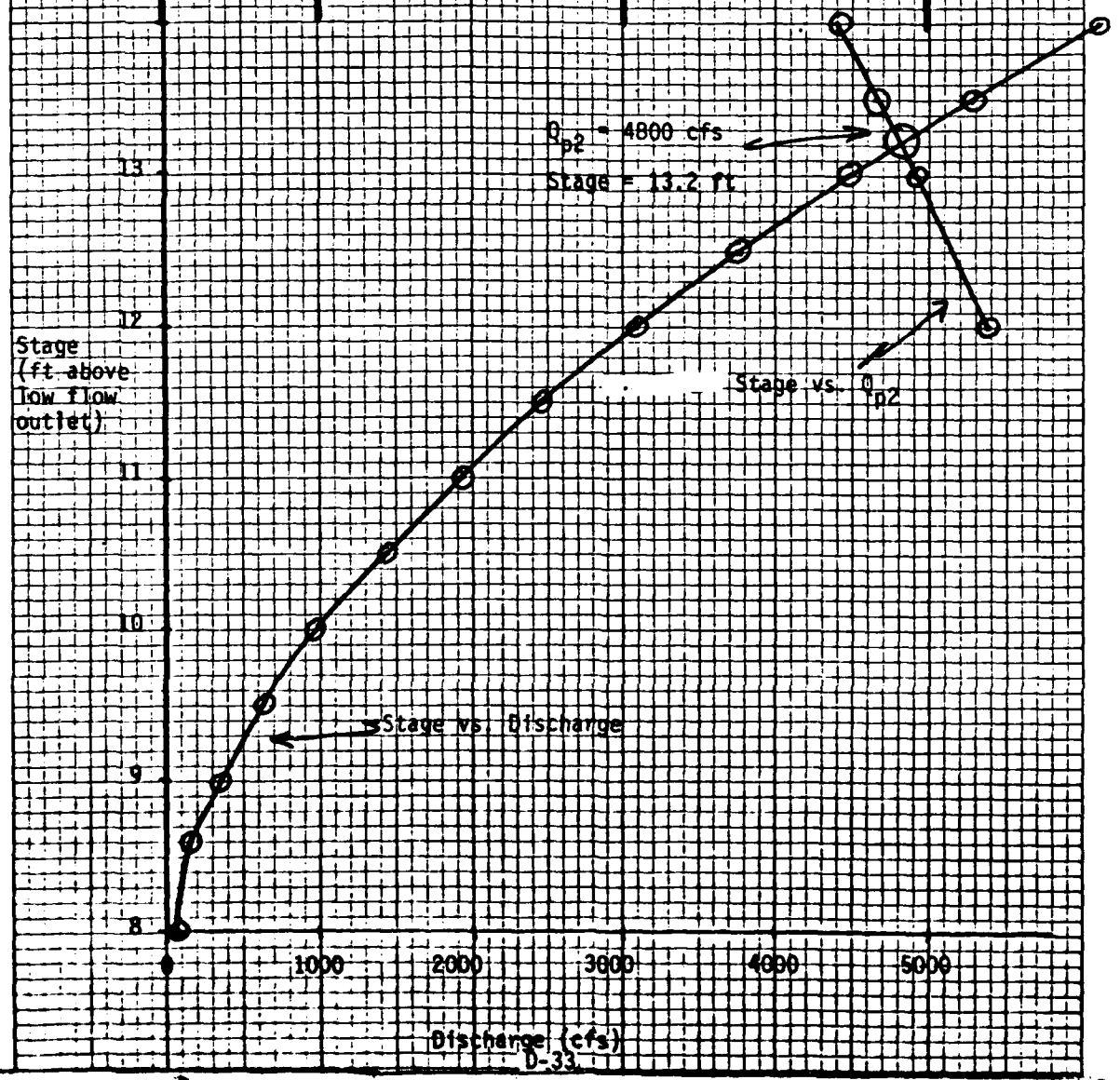
* SCS sometimes uses 5 day & sometimes 6 day. This is a compromise.

Attenuated Test Flood Outflow

TCG, 6/27/79, p. 33

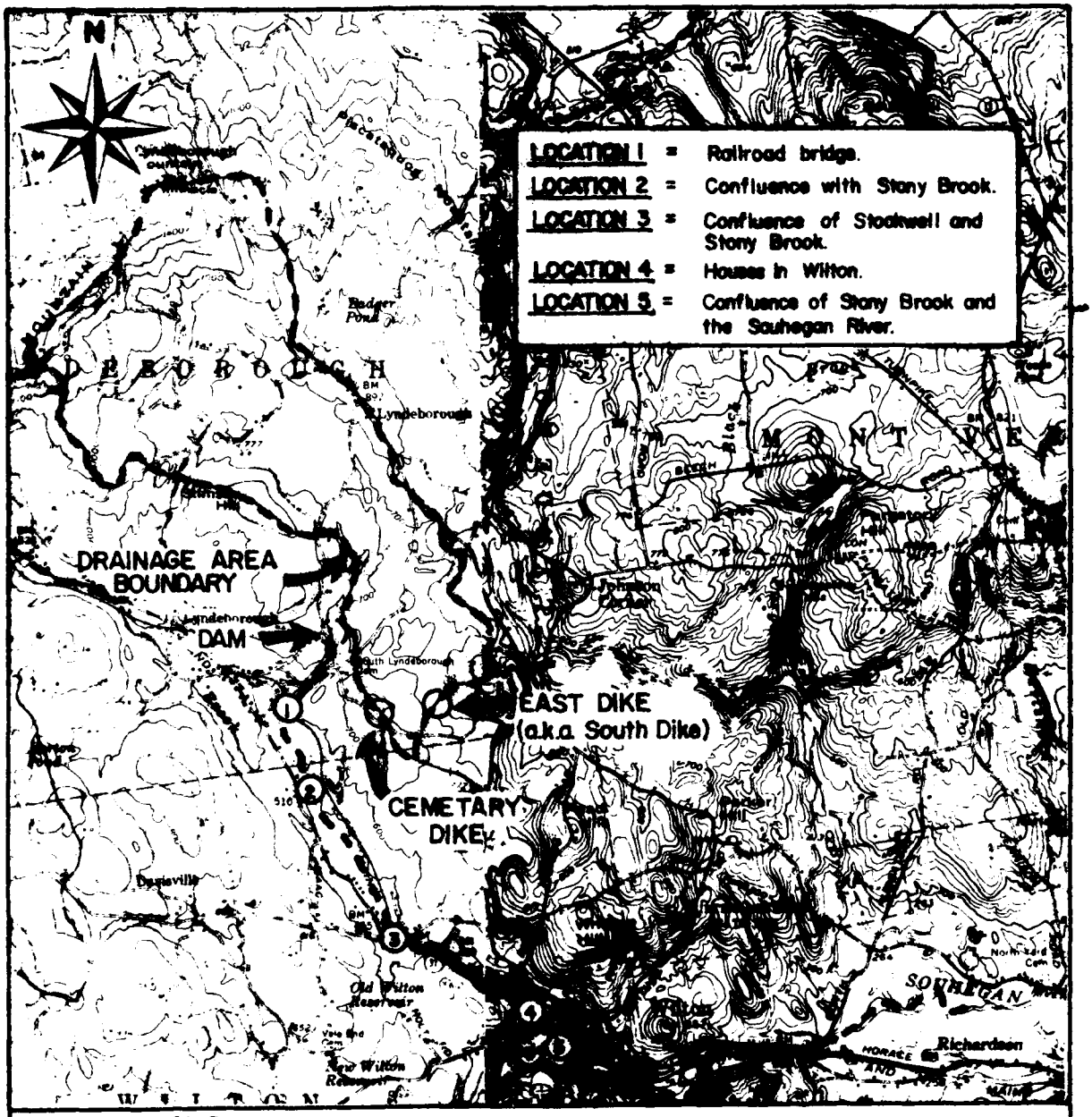
$$Q_{p2} = Q_{p1}\left(1 - \frac{STOR}{19''}\right) = 8390\left(1 - \frac{(STORAGE\ in\ AC\ FT) \times .00422)}{19''}\right)$$

Stage (ft)	Elevation (ft MSL)	Storage (above h = 4) (ac ft)	Q_{p2} (cfs)
12	700.5	1609	5390
13	701.5	1870	4905
13.5	702	2000	4660
14	702.5	2140	4400



Drawdown Time

1 Elevation (ft. MSL)	2 INTERVAL STORAGE (Ac-ft)	3 Discharge (cfs)	4 Average Discharge (cfs)	5 Discharge (Ac-Ft/day) (1.9835 × col 4)	6 Drawdown Time (Days) (col 2 ÷ col 5)	Accumulated Time (Days)
696.5 em. s.w. crest		84				
	190		82.5	163.6	1.16	
695.5		81				1.16
			79	156.7	1.16	
694.5		77				2.32
	162.5		75	148.8	1.09	
693.5		73				3.41
	75		71.5	141.9	.53	
693		70				3.93
	70		67	132.9	.53	
692.5 high stage crest		64				4.46
	50		62	123.0	.41	
692		60				4.87
	52.5		58	115.0	.46	
691.5 → day drawdown		56				5.33
	52.5		51	101.2	.52	
691		46				5.85
	41.5		39.5	78.4	.53	
690.5		33				6.43
	41.5		27	53.6	.77	
690		21				7.20
	10.5		16.5	32.7	.32	
689.5		12				7.52
	10.5		8	15.9	.66	
689		4				8.18
	20		2	3.97	5.04	
688.5 normal pool		0				13.22



– SCALE –

0 1/2 1 2(Miles)

FROM USGS MILFORD AND PETERBOROUGH-N.H QUADRANGLE MAPS

GOLDBERG, ZOINO, DUNNICLIFF & ASSOC., INC.
GEOTECHNICAL CONSULTANTS
NEWTON UPPER FALLS, MASS.

U.S. ARMY ENGINEER DIV. NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

LOCATION AND DOWNSTREAM HAZARD MAP

FILE No. 220

SOUHEGAN RIVER
WATERSHED DAM No. 8

NEW HAMPSHIRE

SCALE AS NOTED
DATE MAY 1979

APPENDIX E

INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS

INVENTORY OF DAMS IN THE UNITED STATES

(1) STATE	(2) IDENTITY NUMBER	(3) DIVISION	(4) STATE	(5) COUNTY	(6) CONGR DIST.	(7) STATE	(8) COUNTY	(9) CONGR DIST.	(10) NAME	(11) LATITUDE (NORTH)	(12) LONGITUDE (WEST)	(13) REPORT DATE DAY | MO | YR
NH	474	NED	NH	011	02				SOUHEGAN RIVER WATERSHED DAM NO 8	4253.1	7146.1	30JUL79

(14) POPULAR NAME	(15) NAME OF IMPOUNDMENT

(16) REGION	(17) BASIN	(18) RIVER OR STREAM	(19) NEAREST DOWNSTREAM CITY-TOWN-VILLAGE	(20) DIST FROM DAM (MI.)	(21) POPULATION
01	05	FURNACE BROOK	WILTON	4	2276

(22) TYPE OF DAM	(23) YEAR COMPLETED	(24) PURPOSES	(25) STRUCTURAL HEIGHT (FT.)	(26) HYDRAULIC HEIGHT (FT.)	(27) IMPOUNDING CAPACITIES MAXIMUM (ACRE-FT.)	(28) IMPOUNDING CAPACITIES NORMAL (ACRE-FT.)
PGFE	1977	C	25	25	2541	

DIST	OWN	FED R	PRV/FED	SCS A	VER/DATE
NED	N	N	N	B	

(29) REMARKS
27-NATURAL POND OF UK STORAGE PRIOR TO DAM

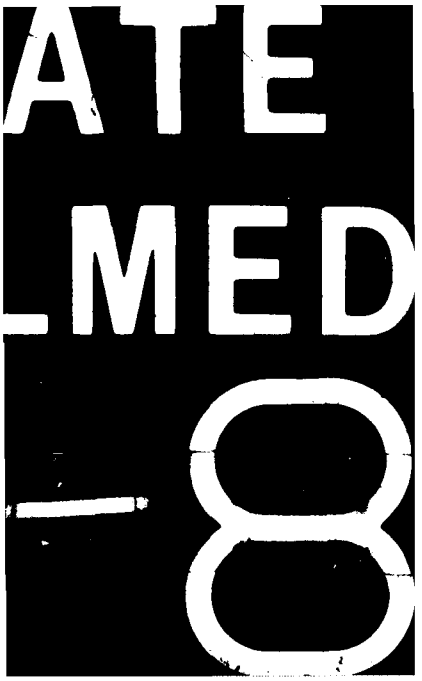
(30) D/S HAS	(31) SPILLWAY CREST LENGTH	(32) SPILLWAY TYPE	(32) SPILLWAY WIDTH (FT.)	(33) MAXIMUM DISCHARGE (FT.)	(34) VOLUME OF DAM (CY)	(35) POWER CAPACITY INSTALLED (MW)	(36) POWER CAPACITY PROPOSED (MW)	(37) NAVIGATION LOCKS NO.	(38) LENGTH (FT.)	(39) WIDTH (FT.)	(40) LENGTH (FT.)	(41) WIDTH (FT.)	(42) LENGTH (FT.)	(43) WIDTH (FT.)	(44) LENGTH (FT.)	(45) WIDTH (FT.)
1	570	U	150	7021	43867											

(46) OWNER	(47) ENGINEERING BY	(48) CONSTRUCTION BY
NH WATER RESOURCES BOARD	USDA SCS	

(49) REGULATORY AGENCY			
DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
NONE	NONE	NONE	NONE

(50) INSPECTION BY	(51) INSPECTION DATE DAY | MO | YR	(52) AUTHORITY FOR INSPECTION
GOLDBERG ZOINO DUNNICLIFF + ASSOC	14MAY79	PUBLIC LAW 92-367

(53) REMARKS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